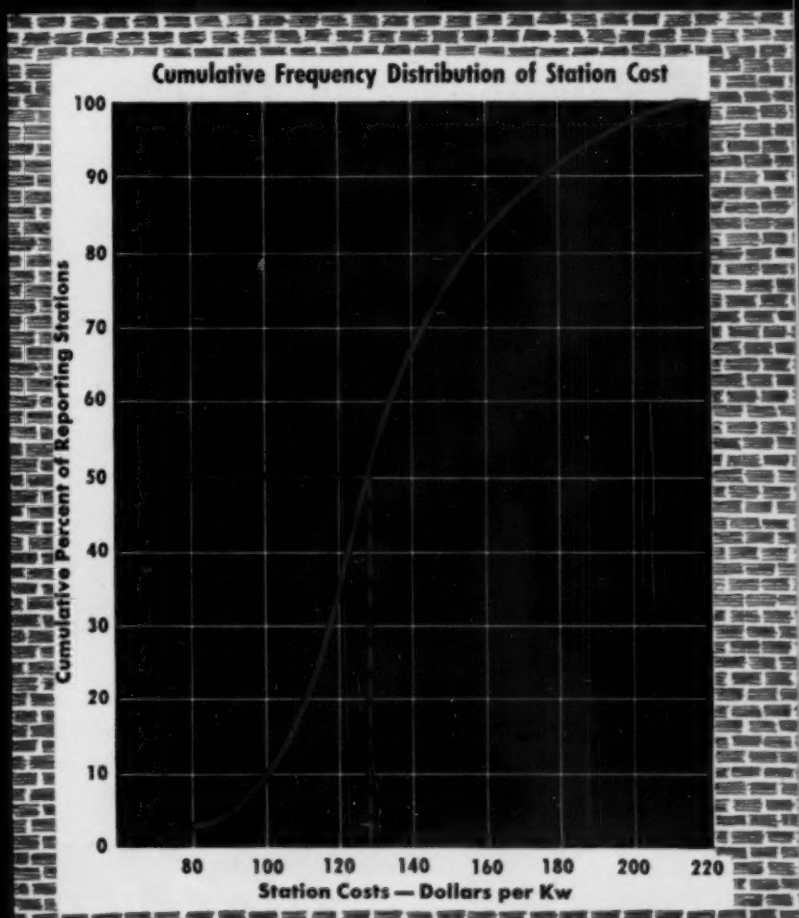
OCTOBER 17, 1955

Electrical World

A McGRAW-HILL PUBLICATION

Price 35 Cents

9th Steam Station Cost Survey . . .



Shows 50% of Stations Were Built for $129 per Kw or Less

PAGES 127-146

Cool savings for Hotpoint...

For the past five years, Hotpoint Co., Milwaukee, has been using *Texaco Regal Oil R&O* for all its turbine lubrication. And here's what L. E. Sweet, Plant Manager, has to say about it:

> ***"Texaco Regal Oil R&O has done a consistently fine job for us. It keeps our turbine blower systems exceptionally clean — no sludge, no rust, no foam. The oil stands up in severe service, bearing temperatures are always normal and governor response always immediate."***

Texaco Regal Oil R&O is a premium-quality oil. Special refining and effective additives *improve* its naturally fine properties, give it an extra long service life and enhance its ability to resist oxidation and prevent sludge, rust and foam.

There is a complete line of *Texaco Regal Oils R&O*. All meet the stringent requirements of leading turbine builders. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Hotpoint 50 Anniversary 1905-1955

HOTPOINT'S GOLDEN ANNIVERSARY is being celebrated this year and Texaco salutes this "Pioneer of the All-Electric Kitchen." We are proud that Texaco Lubricants and Lubrication Engineering Service are so widely used to help speed production of the famous Hotpoint kitchen and laundry appliances.

TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

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ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial and Advertising Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y.

Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Advertising Director; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are solicited only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35c. For the United States and possessions and Canada: $6 per year, $9 for two years, $12 for three years. Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries, $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter at the Post Office at Albany, N. Y. Printed in USA. Copyright 1955 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

Electrical World

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol 144 No. 16 **October 17, 1955**

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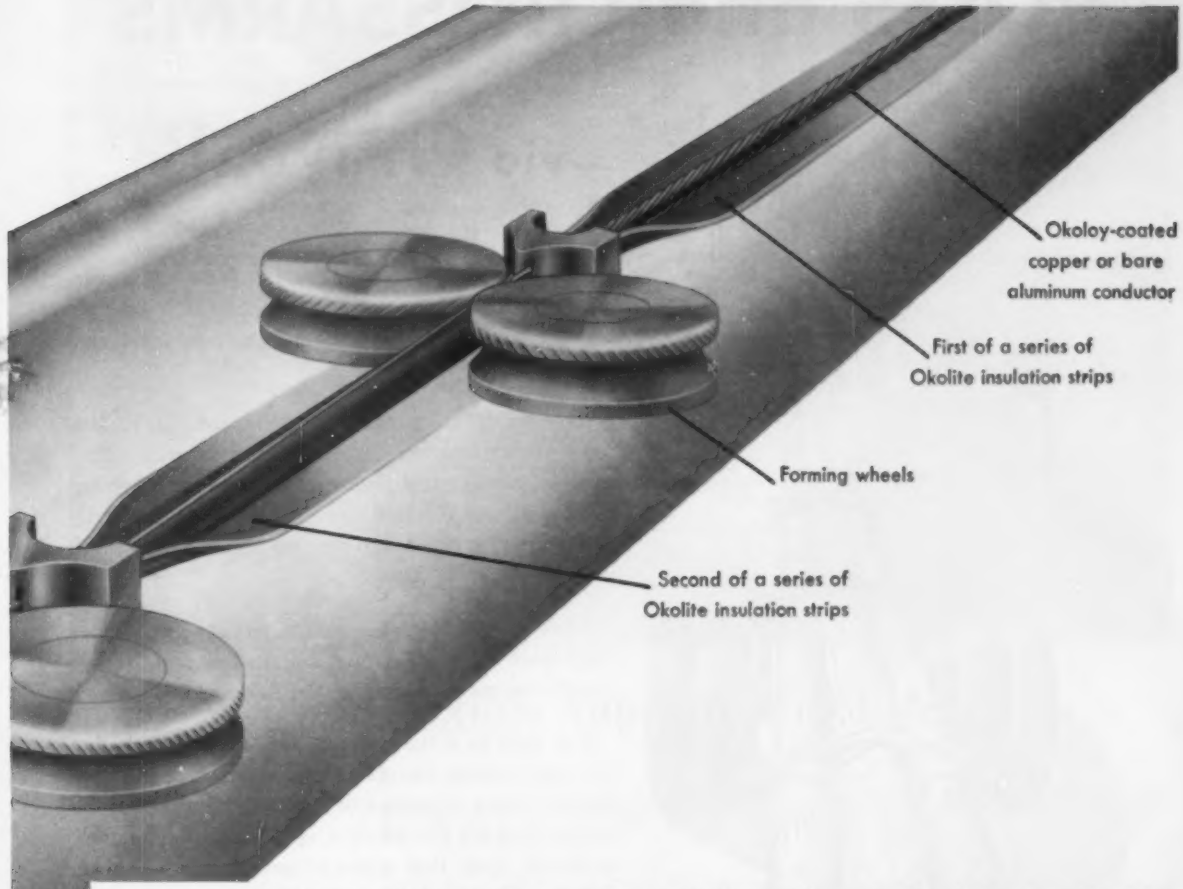
Why the strip-insulating process assures longer cable life...

Look for the Okonite "single ridge"
—your proof of cable quality
Tin mold is removed after vulcanization
Okoprene sheathing strip with tin backing



Okonite uses all the known methods for applying rubber insulation to a conductor. Experience has proved, however, that only one, the strip-insulating process, gives complete assurance of cable dependability. Okonite is the only manufacturer using this costly method in regular production. These are the reasons why all Okolite-Okoprene cables are made by this method:

1. *Perfectly centered conductors.* The strip process is the only insulating method that assures perfect centering of the conductor. This assures an insulating wall of uniform thickness along the entire cable length. There are no "thin spots" which might cause premature failure.

2. *More uniform vulcanization.* Okolite-Okoprene cables are vulcanized under pressure in a continuous metal mold. This provides uniform vulcanization and a tougher, more dense insulation with better physical and electrical characteristics than can be produced by any other method.

3. *Insulation cured only once.* Vulcanizing the insulation and protective sheath in one operation is possible only through the use of the strip method. Thus the evil of multiple vulcanization — shorter insulation life — is avoided.

4. *Strong bond between insulation and sheath.* Single, simultaneous vulcanization of the insulation and sheath together in a metal mold under pressure results in a permanent bond between them. This prevents "push backs" during installation, ionization at potentials above 2000 volts, and water blisters in wet locations.

5. *Quality control.* Unlike any other method, the strip process permits electrical testing and visual inspection of each strip of insulating and sheathing compound both prior to and during application. These controls assure a void-free, uniform, solid dielectric wall. Thus, the strip-insulating process has helped Okonite compile its outstanding service records in countless installations. It is also responsible for the continuing high demand for Okolite-Okoprene cables in circuits that *must not fail.*

Write for 128-page manual (Bulletin EC-1085-A) on 0-5kv unshielded Okolite-Okoprene cables and the strip-insulating process to The Okonite Company, Passaic, N. J.

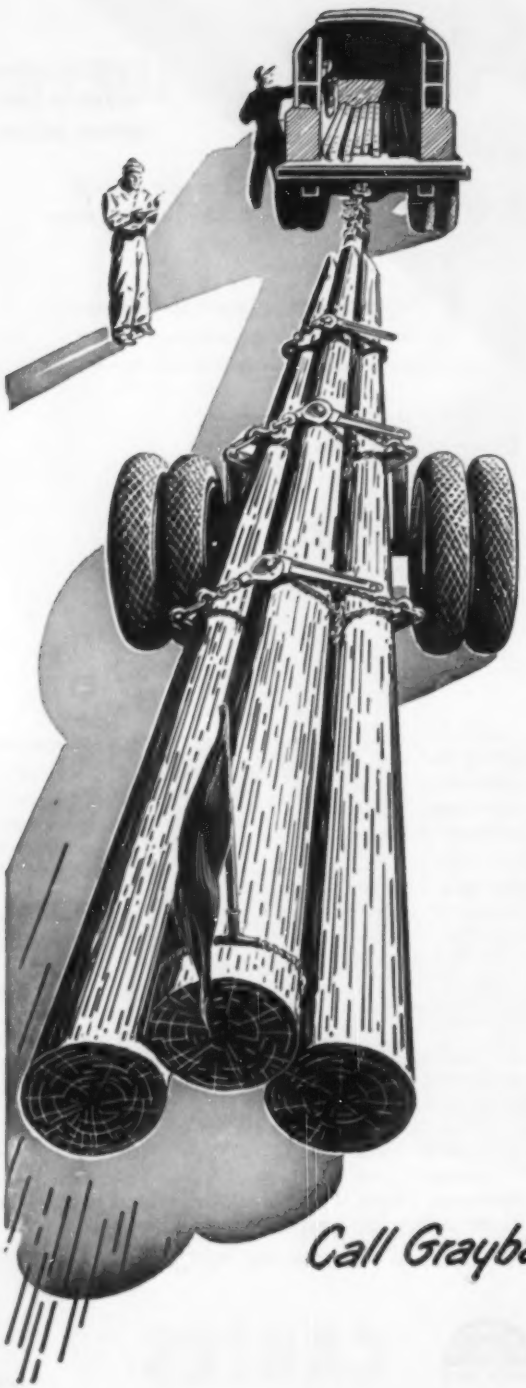
OKONITE CABLES

SINCE 1878

3891

POLES and CROSSARMS

– via GraybaR



There's a type of pole and crossarm for every power-line requirement. And an order placed with Graybar means that you can get the kind you need *when* and *where* you need it.

Because differing conditions influence local preferences, Graybar distributes *all* types of poles – full-length, pressure-treated Fir and Cedar... butt-treated Northern and Western Cedar. They're all carefully selected and processed to provide maximum strength and durability.

Graybar-distributed crossarms are seasoned under rigid methods – are strong, long-lasting and provide a wide margin of safety in the line.

For help in solving usual, and *unusual*, pole-line problems, call on Graybar Outside Construction Specialists – they're located in key areas throughout the nation. And for convenience, speed and direct action, route all your line material orders via Graybar. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

309-910

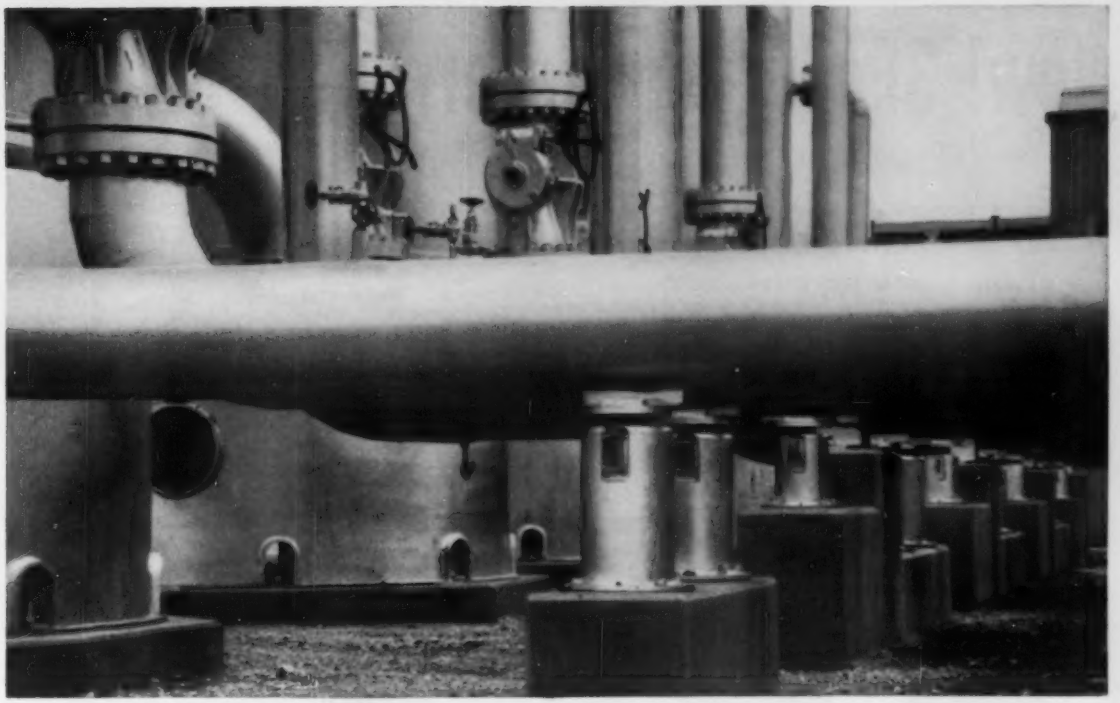
Call Graybar for
POLES AND CROSSARMS

International creosoted Southern Pine poles
National pressure-treated Douglas Fir poles
National full-length pressure-treated Super Cedar poles
National butt-treated Cedar poles
Rainier Fir crossarms

Call Graybar first for...

GraybaR *Everything Electrical*

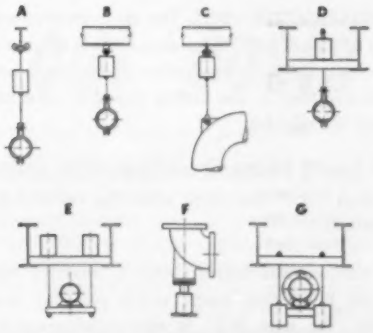
IN OVER 120 PRINCIPAL CITIES



For *flexible* support of piping

Grinnell Pre-Engineered Spring Hangers

AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS



(Type A) Rod threaded to top cap (Type B) Furnished with single lug (Type C) Two lug style (Type D) Top adjusting (Type E) Adjustable top and bottom (Type F) For base support (Type G) Trapeze assembly.

The Grinnell Pre-Engineered Spring Hanger was developed after years of experience in analyzing the problems of flexible pipe suspension systems. It is *pre-engineered* to minimize changes in supporting force over total range of movement. Consider these outstanding features:

- **Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.**
- **Precompression* assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.**
- **Solid steel casing protects spring from damage and weather. Guides assure continuous alignment and concentric loading of spring.**
- **18 sizes available from stock for load ranges from 53 lbs. to 12,000 lbs.**
- **Available in 3 spring lengths for travel ranges of 1¼, 2½, and 5 inches.**
- **Installation is simplified by integral load scale and travel indicators.**

***Precompression is a patented feature.**

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

New! 3E Outdoor Interrupter Switch

BF21 offers important engineering advantages for interrupting full load current of lines and parallel loads.

R. W. Dittus, 3E Sales Manager pointing to the interrupter unit of the new BF21 side break interrupter switch.

CONSTANT HIGH SPEED INTERRUPTION

Contact speed is independent of the time taken to operate the switch for both opening and closing. The interrupter unit for each pole of the switch has its own self-contained high speed mechanism.

COMPLETELY CONFINED ARC. Interruption takes place inside the arcing chamber . . . here the arc created by the interruption is confined and extinguished.

FAST CLEAN INTERRUPTION . . . one cycle or less.

DRY TYPE INTERRUPTER UNIT. The arc is interrupted in the arcing chamber by the pressure and effective blast of gases produced by the action of the arc upon solid material enclosed in the arcing chamber, and no oil or air blast is required.

OVERLOAD CAN'T DAMAGE INTERRUPTER UNIT. The interrupter is out of the circuit when the switch is in the closed position.

THE BF 21 outdoor interrupter switch is basically the efficient, simple BF20 side break switch plus the new interrupter unit. The new BF21 is now catalogued in units through 46 K.V.

3E interrupter switches in voltages up to 115 KV have already been installed. As with the rest of 3E's line, we invite your inquiry for special applications.

3E

ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS, U. S. A.

Cochrane
Solids-Contact Reactors
cut costs

Coagulation and clarification of surface waters, cold lime softening of well or surface waters, removal of alkalinity, silica, fluorides, etc., treatment of white water from paper to recover fibre and warm water are only a few of the many processes performed more efficiently—and at less cost—by a Cochrane Solids-Contact Reactor. Because of the Reactor's special "catalytic" design, the newly-formed precipitates plate out and grow rapidly—provide more complete reactions and produce clear water in shorter time, saving in size of the tanks employed. Chemical savings are impressive, and water waste is kept to a minimum. De-sludging is completely automatic.

Cochrane Corporation designs and manufactures every type of precipitation, ion exchange, deaeration and water conditioning equipment. To obtain equipment best suited to your requirements—consult Cochrane first!

For further information, write for publication 5001-A.

OIL FIELD FLOODING
AN APPLICATION OF COCHRANE REACTORS

Oil field flooding operations require water that is conditioned to prevent precipitates and suspended matter from plugging the oil-producing sandstone formations. Efficient flooding is assured by the Cochrane Solids-Contact Reactor shown above. Softening and clarification are combined in a single unit.

A FEW TYPICAL COCHRANE REACTOR INSTALLATIONS

Application	Use	Capacity gph	Size Reactor Dia.	H.
Oil Field Flooding	Softening & Clarification	350,000	1-72'0"	x19'6"
Process Water for Papermill	Softening	378,000	1-72'0"	x19'6"
Pretreatment ahead of demineralizer	Coagulation	833,400	2-82'0"	x17'0"
Process water for papermill	Coagulation & Softening	180,000	1-47'0"	x17'0"

COCHRANE CORPORATION WATER ENGINEERS SINCE 1863 PHILADELPHIA

Cochrane
CORPORATION

Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.
Pottstown Metal Products Division—Custom built carbon steel and alloy products

3146 N. 17TH STREET, PHILADELPHIA 32, PA.
NEW YORK • PHILADELPHIA • CHICAGO

Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Continuous Blowoff Systems • Condensate Return Systems • Specialties

Semiautomatic production line for manufacturing and cladding fuel elements at Sylvania's Hicksville, N. Y., plant.

Cutaway showing canned fuel element with high-integrity bond (1.5 times actual size).

Inside story of nuclear fuel

THE attainment of economically generated atomic power demands effective performance from the nuclear fuel elements employed. Such a fuel must be capable of high-temperature operation for an extended period of time and some of its important attributes are—

❶ A strong, continuous bond must be present between the metal casing and the core of active material (see illustration above). Voids or discontinuities in the bond may cause hot spots and the premature destruction of the fuel element.

❷ The active core material and casing must be of a physical construction that will withstand incessant bombardment within the reactor—yet allow heat to flow readily and uniformly to the coolant stream.

❸ The bond between casing and end cap must be so complete as to prevent seepage of the coolant into the element core—and the escape of fission products from core to coolant stream.

Techniques for insuring these as well as many other important qualities have been perfected through Sylvania's specializing fuel element research and production facilities. Sylvania's scientists and engineers—pioneers in the development of high, long burn-up fuel—are ready now to help you design fuel economy and reliability into your power production or experimental reactor.

For detailed information, including a newly-published brochure on Sylvania's nuclear energy design and production facilities—write Sylvania Electric Products Inc., Atomic Energy Division, P. O. Box 59, Dept. 2822, Bayside, New York.

SYLVANIA®

ATOMIC ENERGY DIVISION

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

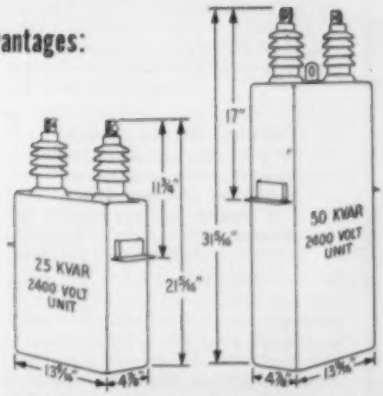
Twice the capacity in the same area . . .

L-M Announces New 50 kvar Capacitor

Line Material's new 50 kvar Elemex® capacitor offers these outstanding advantages:

1. **Fits in existing NEMA standard hangers and L-M single-row racks.** Unit has same width, same thickness as 25 kvar capacitor. Ten inches of additional height give you twice the capacity.
2. **Weighs less per kvar.** A 50 kvar, 2400 volt unit weighs 106 pounds compared to 68 pounds for a 25 kvar unit. Thus a pole-mounted rack of nine capacitors increases weight only 30% and doubles the capacity.
3. **Incorporates outstanding product features of L-M's present 25 kvar unit**—including aluminum metallic coating under alkyd resin paint, "Paragroove" clamp-type connectors, strong solder-sealed bushings, and low-temperature Elemex liquid dielectric.

L-M now offers a line of more compact factory-assembled pole mounted racks in all voltage ratings from 2400 to 7960/13,800 volts, multi-grounded Y.



Only 10 inches of additional height gives twice the capacity

Ask the L-M Field Engineer for information on features, design, and delivery on the new 50 kvar capacitor and capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

Elemex® Capacitors

These Companies Switched to Valve Arresters

Company A, formerly a strong proponent of expulsion type arresters, recently decided not only to switch to valve type, but also now has crews replacing every expulsion arrester on the system.

Company B, a large user of protected transformers, decided to switch to valve type arresters; will no longer buy protected transformers unless they are equipped with valve arresters.

Company C was having trouble protecting equipment with expulsion arresters. At the recommendation of L-M engineers, the company has switched to valve type, has had no more trouble.

Valve Arresters Are Better

Valve type arresters give better protection, are not limited by system capacity, permit better fuse coordination, and last longer than expulsion arresters.

LM

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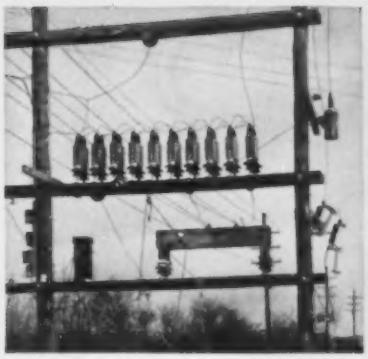
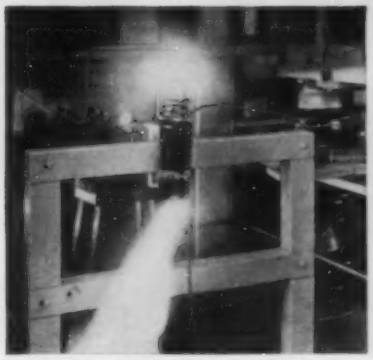
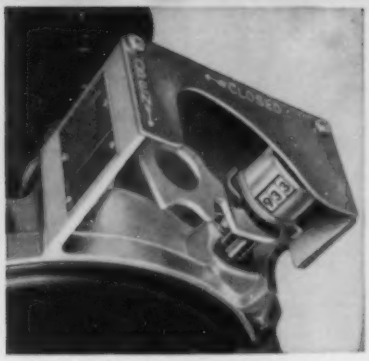
These Companies Prefer Valve Arresters



Company D conducted extensive tests of lightning arresters in its own special field laboratory, to prove that expulsion arresters were satisfactory. But the evidence was the other way; the company continues to use valve arresters exclusively.



Company E was having a large number of outages caused by blown fuses. L-M engineers worked with the utility engineers to locate the cause—traced the fuse blowings to expulsion arresters.



Company F was experiencing an increasing and excessive number of recloser operations. The cause was high follow current passed by expulsion arresters, according to a 2-year study. They are now considering standardizing on valve arresters.

Than Expulsion Arresters

Here's Why...

by **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Company

As a major manufacturer of both valve and expulsion type distribution lightning arresters, L-M is frequently asked—"Which arrester principle is best for my system?"

The question is not a new one. It originated with the advent of the expulsion arrester. At that time, about 25 years ago, utilities were finding moisture, a result of improper sealing, the cause of many valve arrester failures. For this reason interest developed in the expulsion arrester principle. However, in more recent years, positive sealing of the valve arrester has been achieved.

This and other important improvements have been thoroughly tested and proved by operating companies. Field experience has provided the answer: *valve arresters are better than expulsion arresters.*

Regardless of differences in design by various manufacturers, there are certain basic differences in the valve *principle*, as compared with the expulsion principle.

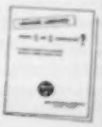
The valve arrester operates on the principle of a valve, which "opens," with low resistance to high voltage, high current lightning surges, and "closes," with high resistance to 60-cycle follow current.

The expulsion arrester operates on the pressure principle, of expelling the power follow current arc. For this purpose a fibre tube must be used to form the gases which expel the arc—and this fibre is subject to erosion—and changing characteristics. These limitations apply regardless of differences in design, manufacture, etc.

Listed at the right are four principal reasons why we recommend valve type arresters over expulsion arresters.

Get Complete Information

Details of some of the extensive evidence in favor of valve over expulsion arresters are given in a new booklet ("Valve versus Expulsion Arresters"). Whichever type you use, we believe you'll be interested in this report. Ask your L-M Field Engineer for a copy, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Div.)



FOUR PRINCIPAL REASONS for recommending valve over expulsion type arresters

1 **Better Protective Characteristics**—The valve arrester sparks over more quickly and at lower voltages on lightning surges. Transformer end turns are not stressed by a complete voltage collapse following sparkover. Although the expulsion arrester provides a satisfactory level of protection for most transformers, a higher degree of protection is available through the proper application of valve arresters.

2 **Unlimited 60-Cycle Capacity**—The application of the valve arrester is not limited by the available short-circuit current. The expulsion arrester, operating on a pressure principle, has a definite top limit and may have a bottom short-circuit current rating. (Too much current causes it to explode; too little fails to expel the arc.)

3 **No Fuse Coordination Problems**—The valve arrester will pass relatively small values of 60-cycle follow current, regardless of system capacity. Expulsion arresters can pass high follow current, which may cause unnecessary operations of sectionalizing devices.

4 **Longer Life**—The valve arrester is electrically and mechanically unaffected in handling lightning discharges usually encountered in service. Its life is relatively unlimited. The expulsion arrester ages and changes its characteristics, because atmospheric conditions and erosion due to operation affect the fibre.

L-M's Type HXO Power Fuse Cutout Interrupts up to 20,000 Amperes

Double-Venting: replaceable fuse link button closes top of tube; on low-amperage faults, the tube vents at bottom only; on high faults, pressure releases button at top, giving double-venting. This insures successful interruptions on both low and high fault currents.

Rated at 200 amperes, with interrupting capacities as follows:

20,000 amps at 7.5 kv
15,000 amps at 15 kv
9,000 amps at 23 kv
5,000 amps at 34.5 kv
4,000 amps at 46 kv

These interrupting capacities apply for full range of fuse link sizes from 1 ampere through 200 amperes.

Replaceable Power Fuse Link

Field-replaceable E-rated power fuse links, similar in design and construction to those used in distribution cutouts. No cartridges to replace, no filler tubes to buy. Designed for positive corona-free operation at high currents and voltages. Ratings and performance meet NEMA Power Fuse Standards.

L-M Power Fuse Links cost only $3.80 each (smaller sizes $1.85) compared to other cutouts requiring complete cartridges at $10 or more. Sizes from 1 to 200 amperes.

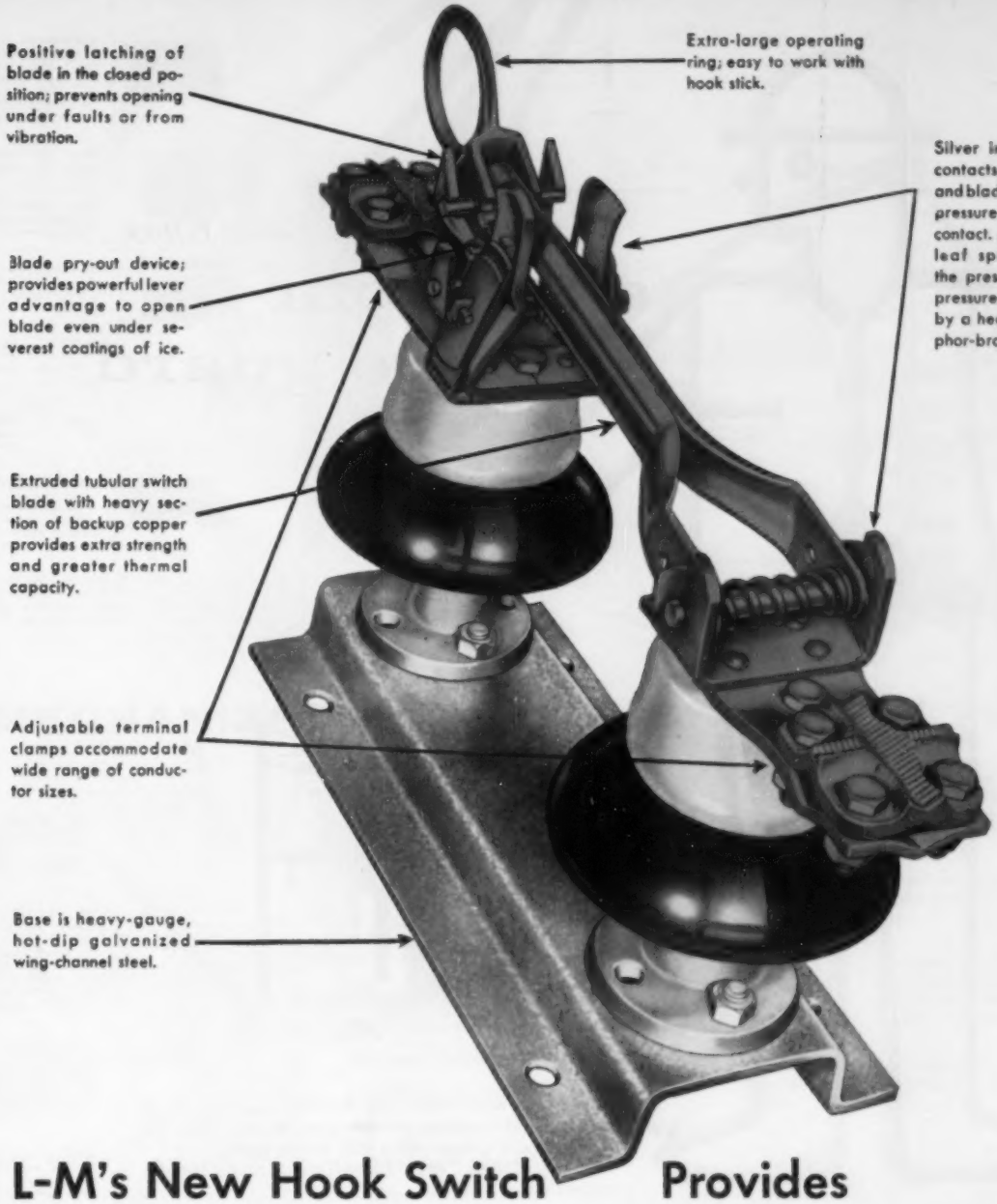
Get Full Information on the HXO

Ask the L-M Field Engineer for details and bulletin, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

fuse cutouts

1178


Positive latching of blade in the closed position; prevents opening under faults or from vibration.
Extra-large operating ring; easy to work with hook stick.
Silver inserts in front contacts, hinge posts, and blade provide high-pressure silver-to-silver contact. At jaw-end the leaf springs provide the pressure. At hinge, pressure is maintained by a heavy-duty phosphor-bronze coil spring.
Blade pry-out device; provides powerful lever advantage to open blade even under severest coatings of ice.
Extruded tubular switch blade with heavy section of backup copper provides extra strength and greater thermal capacity.
Adjustable terminal clamps accommodate wide range of conductor sizes.
Base is heavy-gauge, hot-dip galvanized wing-channel steel.

L-M's New Hook Switch Provides High Thermal Capacity, Trouble-Free Operation

L-M's new outdoor, hook-operated disconnect switch provides high thermal capacity under short-circuit conditions; assures trouble-free service in sectionalizing, disconnecting or by-passing applications.

This new switch can be mounted on either poles or substation structures, in vertical or inverted position.

Outstanding features include: positive blade lock-in and pry-out devices; minimum of current interchange points; heavy copper tubular switch blade; silver-to-silver high-pressure contacts.

L-M's new hook switch is available in single-pole, single-throw and single-pole, double-throw, *in all three sizes—400, 600 and 1200 amperes, 7.5 kv through 69 kv.*

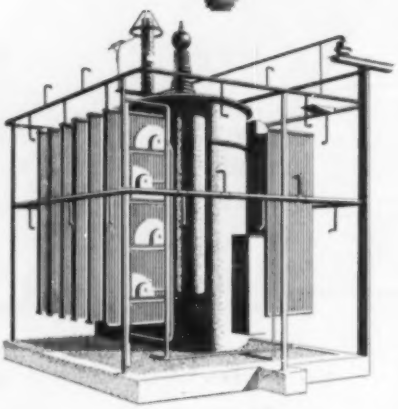
For full information ask your L-M Field Engineer, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LM **LINE MATERIAL** 224R

Power Switching Equipment

engineered by Blaw-Knox...

a 24-hour fire guard



Blaw-Knox fire protection systems carry approvals of all insurance underwriters.

Deluge Systems • Wet Pipe Systems • Dry Pipe Systems • Water Spray and Fog Systems • Rate-of-Rise Sprinkler Systems • Foam and Carbon Dioxide Extinguisher Systems

Blaw-Knox Automatic Fog Systems, engineered to your special hazards, are fire guards that work for you 24 hours a day, every day in the year.

If fire strikes, your Blaw-Knox fire protection system will:

- **smother flames and dissipate heat**
- **protect adjacent equipment**
- **prevent plant destruction and loss of revenue**
- **prevent service interruption**
- **avoid customer complaints**

Let Blaw-Knox engineers study your fire protection requirements. They will submit a layout and cost estimate, at no obligation. Why not call us today.

Send for a copy of our booklet, *Fire Can Destroy Your Business.* You'll find it full of interesting facts.

"Little Joey Sprinkler" always on the job

BLAW-KNOX COMPANY

Automatic Sprinkler Department / Pittsburgh 33, Pa.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 75", 84", 90" and 102".

Tree trimmer body accommodates 7-men crew. Aerial and winch equipment optional. Side rack hinges for easy unloading of brush.

Gas Service body with forward-mounted air compressor, independently engine driven.

Model 4401-M Holan Portable Earth Borer takes the drudgery out of digging. Ratchet overload clutch eliminates changing shear pins. High angle torque arm permits boring in hilly ground.

MECHANIZED "MOLE" WITH A NEW TWIST

Hydraulic derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Portable mechanical and hydraulic earth borers with optional rotation.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

Your hole boring problems challenged Holan engineers to fashion a truly efficient portable digger . . . one that would obsolete earlier models. Instead of modifying existing equipment, they started with a blank sheet and *engineered* from the ground up! The few mechanical details shown here hint at the many benefits you will gain from a HOLAN borer . . . benefits in cost, service, safety, durability, performance . . . *and* crew morale!

WRITE FOR DETAILS.

Request 4401-M Folder.

Torque arm drive shaft is 2" square tubular steel telescoping into 3½" round tube . . . extremely rigid and lightweight.

Specially designed pinion and ring gear housing is rugged impact-resistant malleable iron.

Heavy-duty Holan auger with shallow-pitch steel flighting welded to seamless steel shaft. Hardened edge beading optional.

Engine wise or counter-engine rotation available for corresponding drives.

Extra steep angle universal joints provide wide range in rolling terrain.

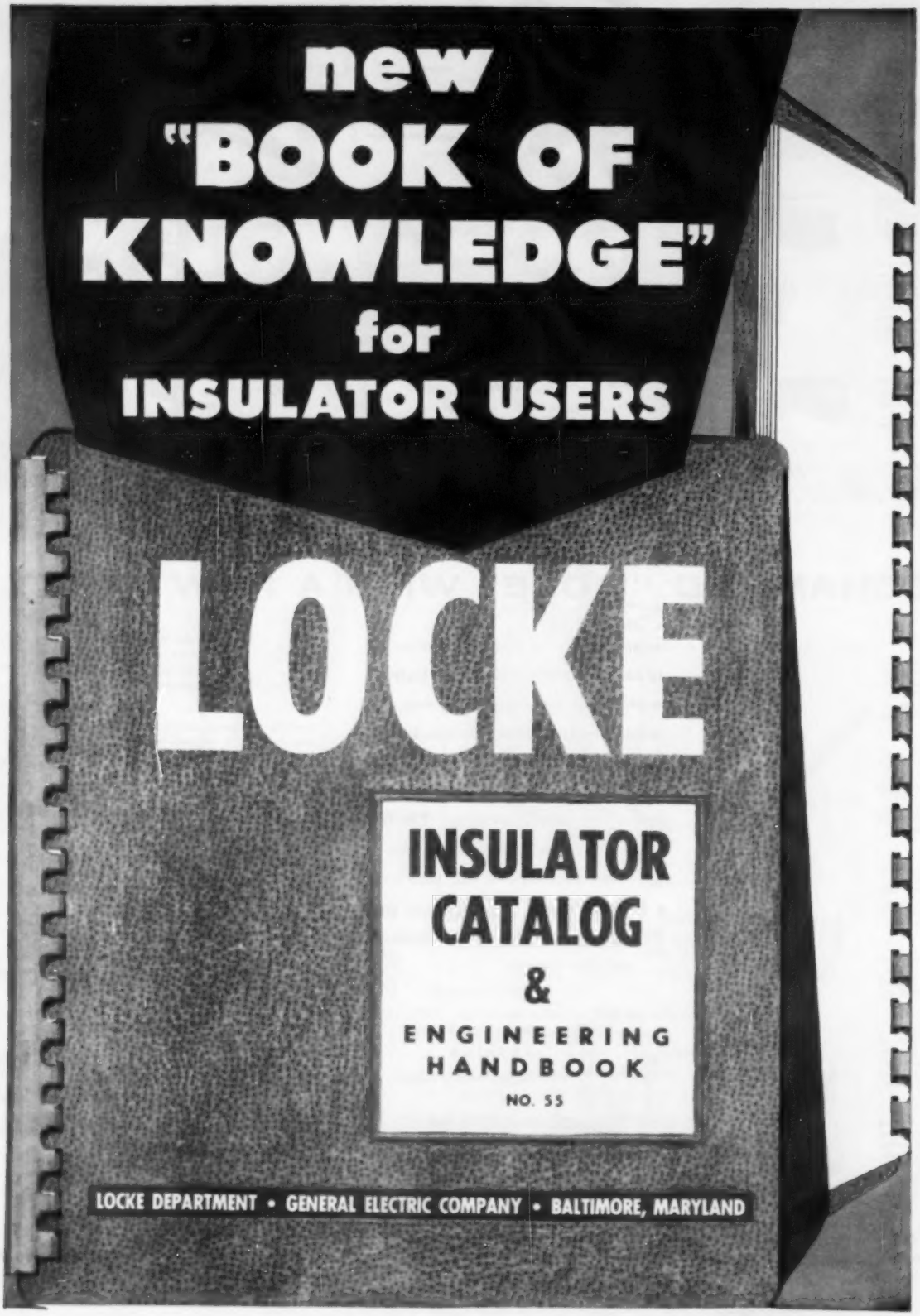
Shaft Bearings and oil seals are highest quality to reduce frequency of service repairs.

Self-centering type cutting head with balanced thrust reduces wear. Specially hardened replaceable points and pilot bit.

"You"-tility Engineered by J. H. HOLAN CORPORATION

4100 WEST 150 ST. • CLEVELAND 11, OHIO

THE NAME THAT MEANS WORK SIMPLIFICATION


new
"BOOK OF KNOWLEDGE"
for
INSULATOR USERS
LOCKE
INSULATOR CATALOG
&
ENGINEERING HANDBOOK
NO. 55
LOCKE DEPARTMENT • GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

Locke's Insulator Catalog and Engineering Handbook

Designed to become your favorite source for complete, authoritative purchasing and engineering information on insulators and insulator hardware.

Included in its 233 pages of easy-to-use, alphabetically and numerically indexed material, you'll find these important features:

1. A completely new insulator product section, thumb indexed, makes it easy for you to quickly locate any one of over 800 insulators or insulator hardware items.
2. Complete description of physical characteristics of porcelain.
3. Six pages of clamp recommendations for various conductors.
4. Large section on lightning performance of transmission lines.
5. An expanded section on apparatus bushings with application and maintenance information.
6. Complete listing of all EEI-NEMA Standards, including proposed standards for apparatus insulators. (TDJ-58, 59)
7. The complete American Standards for apparatus bushings and test code.
8. A large general data section including standard insulator tests, cable specifications and many valuable tables for general calculations.

Your copy of this lightweight, spiral bound Insulator Catalog will be supplied by your local Locke Representative.

LOCKE

why soot is no problem... with the Ljungstrom® Air Preheater

Soot is no problem with the Ljungstrom. Clinging soot or slag is loosened by normal expansion and contraction of the preheater . . . and most of it is blown away by the high-velocity gas streams. What remains is removed by superheated steam or compressed air, fired from oscillating soot blowers, while the Ljungstroms are in operation.

What's more, moderate deposits on the Ljungstrom heating surface have no effect on preheating. For, with the Ljungstrom, heat need not pass through a film-coated wall — but is simply absorbed by a heating surface and *released from the same surface.*

Get all the details on why the Ljungstrom is easier to clean and maintain . . . maintains higher boiler efficiencies. They're in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for your free copy, today!

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

GLASS-STRAINS OF *Fiber Glass*

WITH TENSILE STRENGTH THAT EQUALS STEEL

NEW

highly dependable and low-cost guy strain insulator development

In developing Fiber Glass Guy Strain Insulators, Empire Metal Products Company has succeeded in producing units of high impulse insulation value — light weight — permanent dielectric characteristics and unchanging physical properties. Now you are assured of maximum compensation for any loss of insulation in the structure.

In addition to its high tensile strength, the fiber glass rod has very desirable resilient characteristics. The resiliency gives the Glass-Strains ability to absorb shock loads. Fiber glass resists weathering and moisture absorption—therefore, the impulse flashover characteristics of Glass-Strains remain virtually the same as a rod gap under all conditions either wet or dry. Glass-Strains do not require arcing horns which assures a neat appearance when installed. The small size and light weight are advantages in shipping costs, handling ease, and storing convenience.

DIMENSIONAL CHART

	"A"	"B"
703	34⅝"	43½"
703-5	54"	62⅞"
703-7	78"	86⅞"

18,000 lbs. minimum breaking strength

DIMENSIONAL CHART

	"A"	"B"
800	34⅝"	45½"
800-5	54"	64⅞"
800-7	78"	88⅞"

25,000 lbs. minimum breaking strength

Manufacturing procedure includes tensioning all units beyond normal working load. The end fittings have been carefully designed to provide the ultimate in strength and holding power. The time-proven wedge principle is used to make a self-tightening connection between fitting and rod.

Empire Metal Products Co.

5443 WEST ROOSEVELT ROAD

CHICAGO 50, ILLINOIS

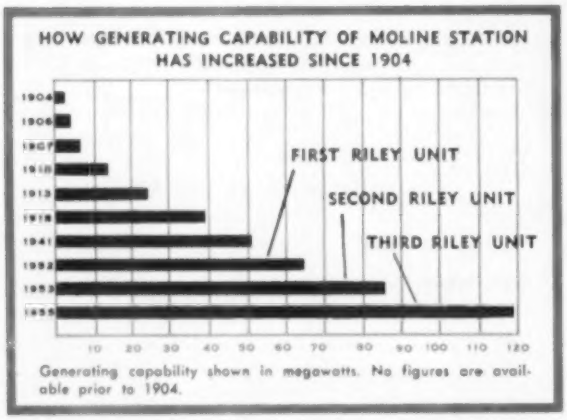
Another **POWER MODERNIZATION AWARD** featuring **RILEY Steam Generating Equipment.**

Iowa-Illinois Gas & Electric Company employs sound dollar-saving planning in modernizing its MOLINE STATION

retires ten old boilers - puts three RILEY

Results

1. Increased plant capabilities from 53,000 kw to 119,000 kw.
2. Reduced heat rate 24%.
3. Cut kilowatt production cost by 2 mills.
4. Lowered plant per kilowatt investment from $131 to $113.



SEVEN RILEY UNITS HAVE BEEN PURCHASED BY IOWA-ILLINOIS GAS & ELECTRIC COMPANY SINCE 1942

Riverside Station, Davenport, Iowa
1942—One 250,000 lbs/hr Unit—975 psi, 825 F
1946—Two 250,000 lbs/hr Units—1000 psi, 900 F

Coralville Plant, Iowa City, Iowa
1948—One 60,000 lbs/hr Unit— 500 psi, 730 F

Moline Station, Moline Iowa
1950—One 200,000 lbs/hr Unit—925 psi, 825 F
One 200,000 lbs/hr Unit—825 psi, 900 F
1952—One 250,000 lbs/hr Unit—975 psi, 905 F

Total Steam Generating Capacity — 1,460,000 pounds per hour

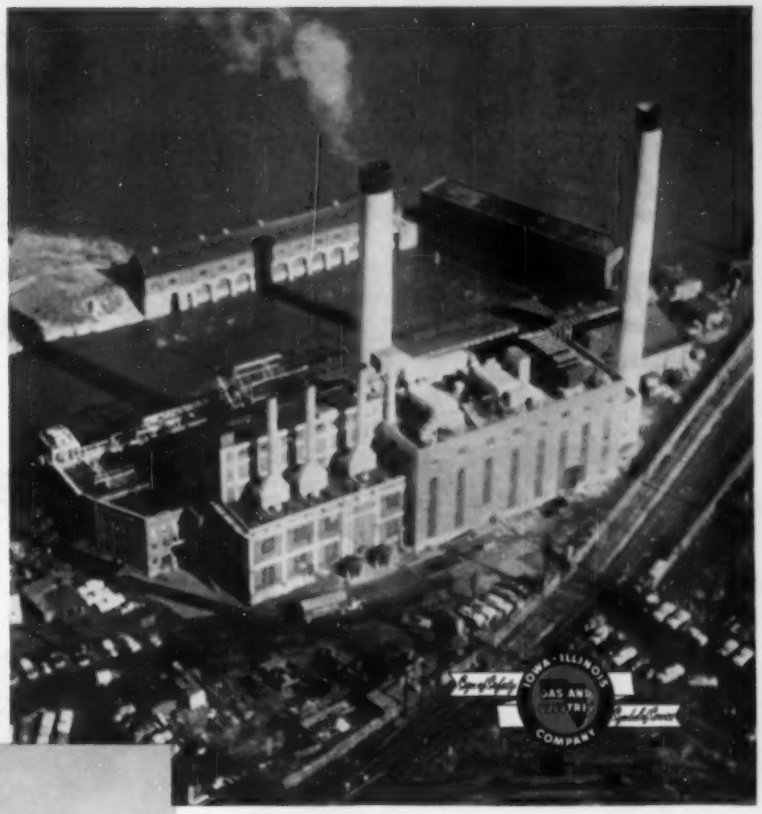
As a result of a carefully planned two-stage modernization program, Iowa-Illinois Gas & Electric Company's Moline Station now is a modern 119,000 kw generating plant with high operating efficiency. Three Riley Steam Generating Units installed since 1951 have replaced ten old boilers originally installed in 1906. Teaming up with six retained units of the original plant the new Riley units are credited with substantially cutting kilowatt production costs, lowering heat rate and actually reducing the per kilowatt ratio of plant investment.

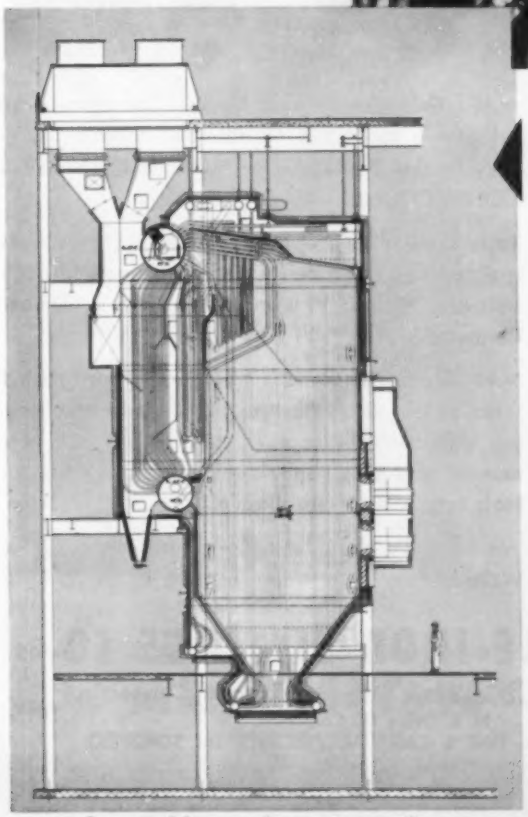
A further result of this outstanding modernization program was the winning of POWER Magazine's Modernization Award in 1954 — a tribute to the sound and realistic economic planning and engineering on the part of Iowa-Illinois Gas and Electric Company and its consulting engineers, Sargent & Lundy.

Moline Station serves the quad-cities of Moline, Rock Island, East Moline, Illinois, and Davenport, Iowa, and supplements the 140,000 kilowatts of the Riverside Station located at Davenport. Riverside Station has three pulverized coal fired Riley units each with a steam generating capacity of 250,000 pounds per hour.

RILEY designs, engineers, manufactures and erects complete steam generating

units on the line





THE third Riley unit installed at Moline Station operates at 250,000 lbs/hr at an efficiency of 88.4% with steam temperature at 905 F and pressure at 825 pounds. Six Riley horizontal flare type forced draft burners are installed for firing oil, natural gas and future coal. The increase in steam temperature from 825 F to 905 F decreased heat rate 2.6%.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY

Stoker Corporation

WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

units for Public Utility Central Stations and Industrial Power and Heating Plants

Varied problems?

BUTT OR LAP JOINTS AT ANY ANGLE

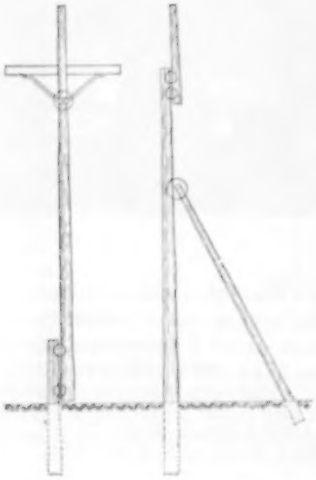
WOOD TO WOOD

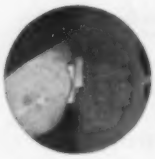
ROUND TO ROUND
ROUND TO DIMENSION
DIMENSION TO DIMENSION

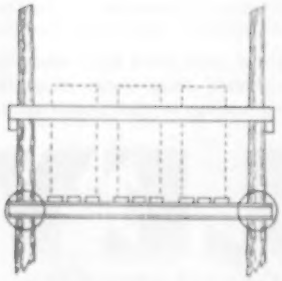
WOOD TO METAL

Versatile answer!

M.I.F. GRID GAINS and TIMBER CONNECTORS







M.I.F. Grid Gains and Timber Connectors are adaptable to dozens of different applications — they make STRONGER, MORE DEPENDABLE CONNECTIONS.

Tests show that shear forces four to five times greater than could be resisted by a single through bolt are attained by using Grid Gains or Timber Connectors.

M.I.F. Grid Gains and Timber Connectors permit fuller utilization of the strength of wood by allowing higher design loads in shear — for both permanent and emergency construction. No special tools required for installation.

We have the story for you in our Bulletin PH10. Write us.

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N. Y. Office: 30 Church St.

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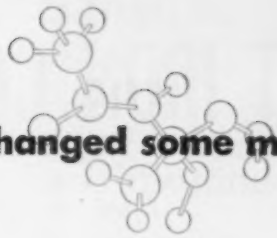
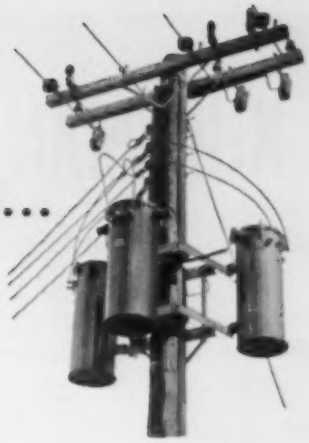
Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill., Lee-Smith Co., Miami, Fla. • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Robert P. Smith & Co., Jacksonville, Fla., E. A. Thornwell, Inc., Atlanta, Georgia • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Calif. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas and Houston, Tex. • O. C. Witte Co., Detroit, Mich.



Du Pont changed some molecules . . .



to produce the higher heat resistance of ALATHON®

polyethylene resin

From the Du Pont laboratories comes "Alathon" polyethylene resin with increased heat resistance for insulation and jacketing. This extra measure of protection for copper and aluminum conductors is in addition to other important properties, such as weatherability.

Jacketing of "Alathon" has outstanding dielectric strength. This material is lightweight and pliable; linemen find it easy to handle. Jacketing of "Alathon" provides real economy because it lasts for years without festooning or splitting. Another advantage is its low rate of water absorption.

For more property and application data on the family of Du Pont "Alathon" polyethylene resins, clip and mail the coupon below.

There is a difference in polyethylenes - specify ALATHON®

polyethylene resin

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 3510, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for

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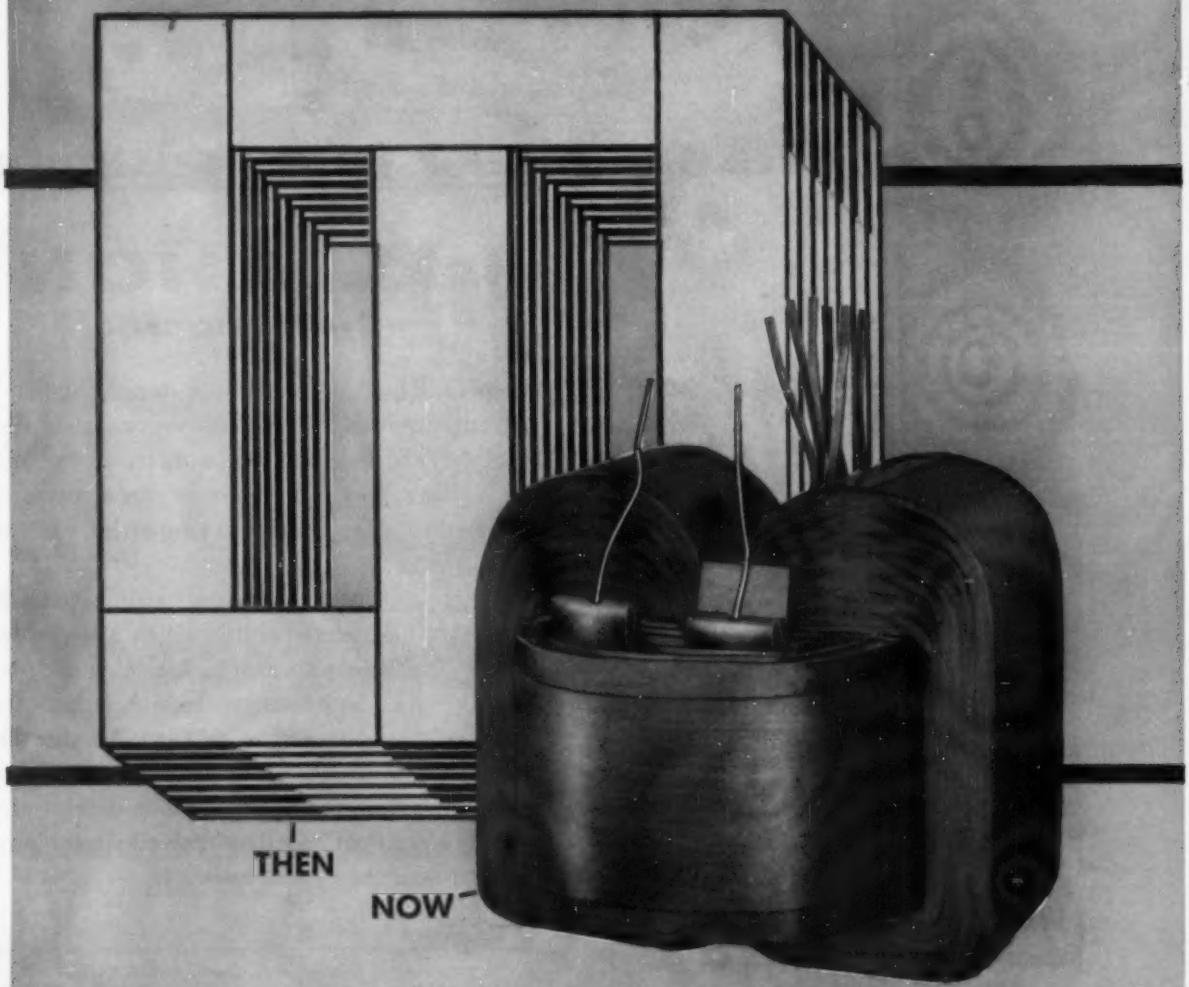
the KUHLMAN BENT IRON CORE...

THE SMALLER, THE LIGHTER, THE REVOLUTIONARY CORE



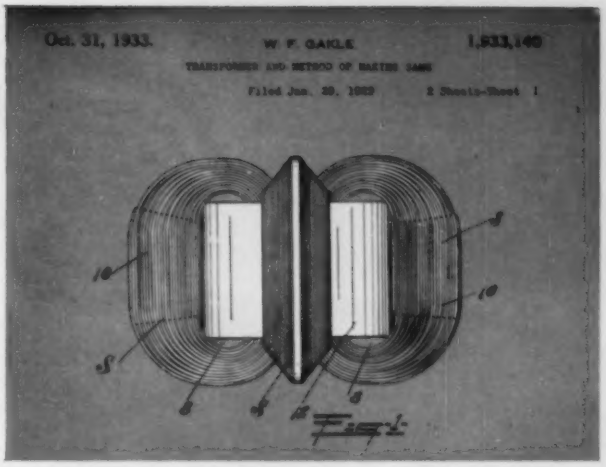
KUHLMAN

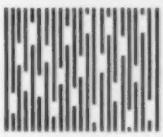
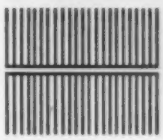
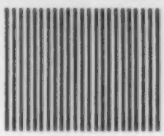
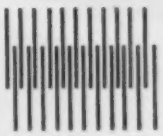
KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN, CRYSTAL SPRINGS, MISSISSIPPI, SALINAS, CALIFORNIA

"an industry first"

Patent #1,933,140 revolutionized core design

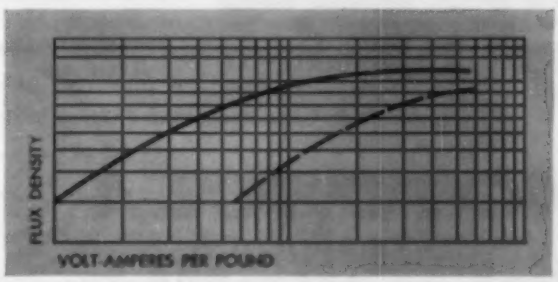
In 1933 Kuhlman was granted Patent #1,933,140 (application filed 1/29/29) on the radically different Bent Iron Core and by 1935 the new core was the first and only core of its kind on the market. The Bent Iron Core not only gained the electrical industries' unanimous acceptance but precipitated a revolution in transformer design, and today, through the use of better materials and improved manufacturing processes, the Kuhlman Core still retains its leadership over other types of cores. Compare the outstanding advantages of the Bent Iron Core's principle of lapped joint construction with other methods of core construction.



CORE CONSTRUCTION FEATURES	 A	 B	 C	 KUHLMAN
Flux density in joint area of core	High	Normal	—	Low
Core loss reduced in joint area of core	no	no	—	yes
Exciting current reduced in joint area	no	no	—	yes
Assembly of core after anneal prevents possibility of adhesions between laminations with resulting increase in core loss	yes	no	no	yes
Good space factor — windings in core window	yes	yes	no	yes
Extra copper in windings required by poor space factor	no	no	yes	no
Efficient design with no increase in over-all weights and dimensions	no	no	no	yes

Kuhlman Distribution Transformers are smaller and lighter

The cold rolled oriented silicon steel used in the Bent Iron Core permits the flux path to follow the grain of the steel resulting in a higher flux carrying capacity and a smaller, lighter core. Less copper is needed in the windings, thus reducing the size and weight of the coil. The smaller tank made possible by the Bent Iron Core and coil assembly makes Kuhlman Distribution Transformers easier and less expensive to handle, saves both storage and pole space, and permits the installation of higher KVA on poles.



——— Flux path parallel to grain of steel.
— — — Flux path transverse to grain of steel.

To get Bent Iron Core features order KUHLMAN Distribution Transformers

164

THE NEWEST AND FINEST IN 2-WAY RADIO

. . . with quality and value above all.

The new look—the new sound—now available in the most complete line of precision built, two-way radio models, vibrator or dynamotor powered . . . featuring foolproof 6/12 volt interchangeability, the solution to today's installation problems in mixed fleets of 6 and 12 volt vehicles.

These new **Twin-V** models give you improved communications range, maximum intelligibility through better receiver sensitivity—better circuitry for control of ignition noise, "hash" and other interference—better audio response for clearer, crisper voice messages that get through even under the worst conditions. The new acoustically matched **Twin-V** radiophone speaker and speaker enclosure assure unexcelled voice reproduction. Instantaneous squelch operation reliably blocks out nuisance noise while maintaining maximum sensitivity to consistently receive the weakest usable signals.

Here is equipment designed to new higher performance standards—built to last . . . built to accommodate changing operating conditions, economically and functionally . . . built to more readily accommodate conversion to split-channel conditions. All Motorola units are fully field tested, proved in use, proved for sustained peak performance, proved for minimum maintenance.

with MANY NEW, EXCLUSIVE FEATURES

There is a model designed for each and every application in the 24-54 mc., 144-174 mc., and 450-470 mc. frequency ranges, with a wide selection of transmitter power output ratings to serve your varied communications requirements. Take your choice of compact, economical, vibrator powered models or rugged, long life, dynamotor powered units to serve your specific operational needs.

Get the complete details. Write, phone or wire:

MOTOROLA

2-WAY RADIO

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC.
A SUBSIDIARY OF MOTOROLA, INC.
4501 AUGUSTA BOULEVARD • CHICAGO 51, ILLINOIS
ROGERS MAJESTIC ELECTRONICS LTD. TORONTO, CANADA

Motorola consistently supplies more mobile and portable radio than all others combined.
Proof of acceptance, experience and quality.
The only COMPLETE radio communications service—specialized engineering . . . product . . . customer service . . . parts . . . installation . . . maintenance . . . finance . . . lease.
"The best costs you less—specify Motorola."

SIMPLEX ANHYDREX XX

Deserves its tremendous popularity!

- Simplex-ANHYDREX XX insulation is made for cable operating at 3kv to 25kv and over.
- It resists heat, ozone, oxidation and water even AFTER *aging for 7 days at 250°F.*
- Rated at 85°C. to 15kv and at 80°C. above that, it's used in ducts, overhead on messenger wires, or underground.
- ANHYDREX XX eliminates need of a lead sheath.
- It eliminates problems of oil migration, sheath creeping, corrosion, electrolysis, bonding and joint wiping.
- ANHYDREX XX-insulated cable is lighter and more flexible than lead-covered cable.
- ANHYDREX XX Cable is made with a tough neoprene jacket, submarine armor wire, or other suitable outer covering.

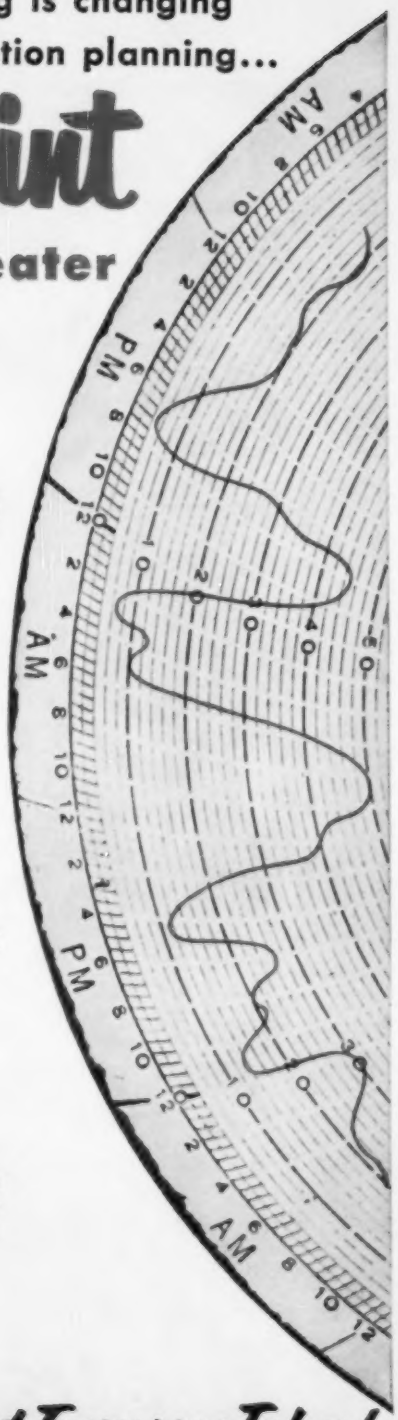
Simplex Bulletin 1009A tells more about ANHYDREX XX high voltage insulation. Write for it today.

Simplex **ANHYDREX XX CABLE**

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Air conditioning is changing load and distribution planning...

Now Hotpoint Offers a Water Heater That Fits This New Load Trend!



the new Hotpoint super-speed automatic

A progressive idea in electric water heating—the new 40-gallon Hotpoint Super-Speed Automatic meets the maximum hot water needs of 95% of all users everywhere . . . provides more than 6 times the needs of the average family.

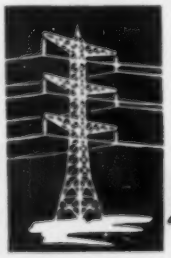
Actual laboratory tests have proved the new Super-Speed equals or out-performs any rated heater of comparable size, regardless of heat source. It can deliver 30% to 60% more hot water every 24 hrs. than a standard 82-gal. heater—60 to 90 gallons of hot water in less than 2 hrs.—up to 470 gallons every day! Recovery? From a cold start, with 50° water, it delivers enough hot water for 3 shower baths in just 25 minutes . . . enough really hot water for an automatic washer load in about an hour.

This fast recovery heater peaks at mid-morning when the residential load is usually low. In companies already providing, or contemplating, increased distribution facilities for air conditioning, this is a time when additional use of these facilities will be advantageous.

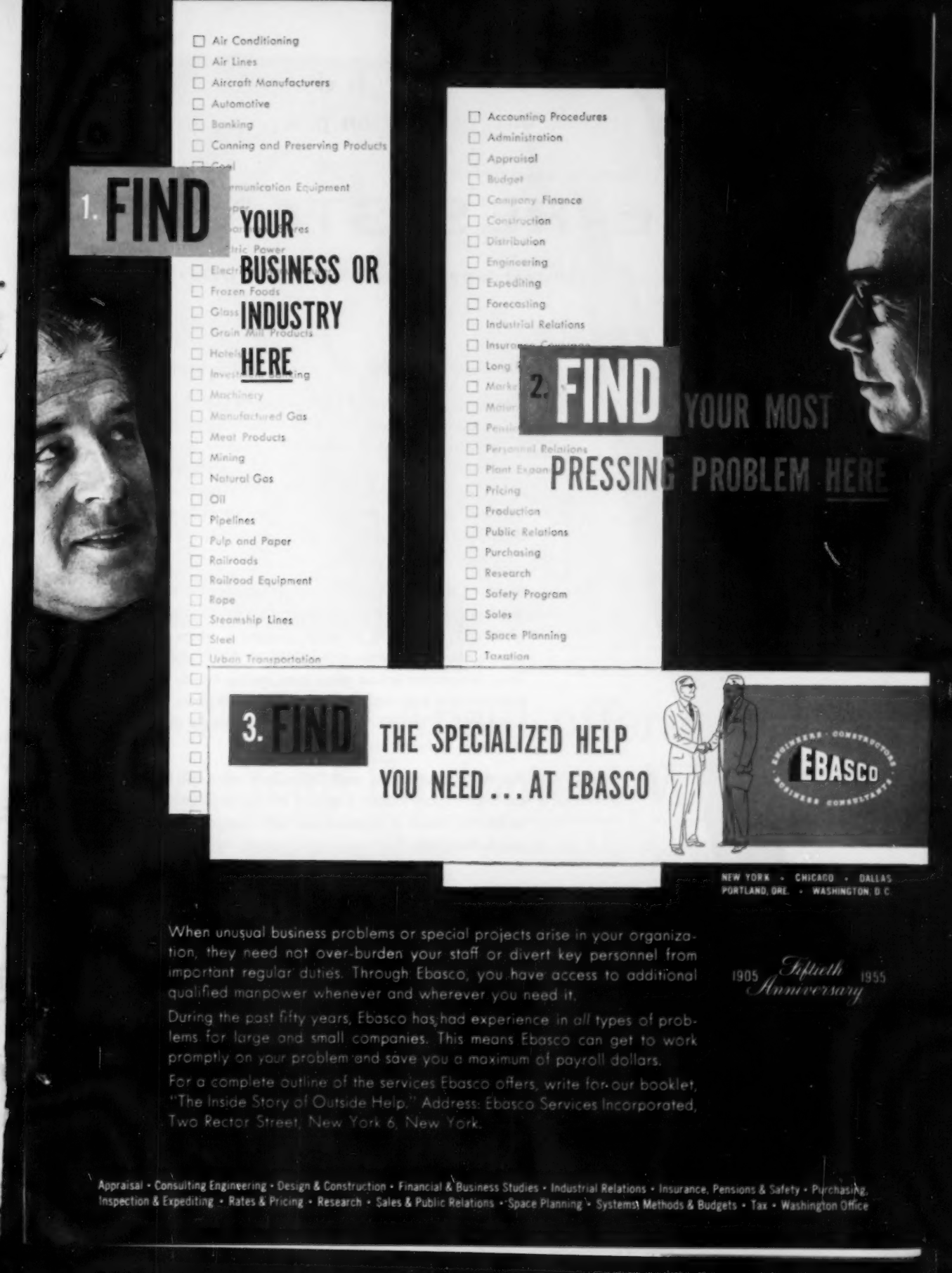
Of course load and demand figures must be related to your local situation. Many major utilities are now testing Super-Speed heaters on their lines. A limited number have already completely embraced this new fast recovery idea and are actively merchandising "better hot water service at no extra cost."

If you would like to see what the new Super-Speed will do for your load and merchandising picture—write to Utility Division, Hotpoint Co. The new Hotpoint Super-Speed program for utilities is completely flexible.

Again, Hotpoint looks at Tomorrow, Today!



HOTPOINT CO. *(A Division of General Electric Company)* **5600 West Taylor Street, Chicago 44, Illinois**


Air Conditioning
Air Lines
Aircraft Manufacturers
Automotive
Banking
Canning and Preserving Products
Frozen Foods
Machinery
Manufactured Gas
Meat Products
Mining
Natural Gas
Oil
Pipelines
Pulp and Paper
Railroads
Railroad Equipment
Rope
Steamship Lines
Steel
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When unusual business problems or special projects arise in your organization, they need not over-burden your staff or divert key personnel from important regular duties. Through Ebasco, you have access to additional qualified manpower whenever and wherever you need it.
During the past fifty years, Ebasco has had experience in *all* types of problems for large and small companies. This means Ebasco can get to work promptly on your problem and save you a maximum of payroll dollars.
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97 times more OZONE RESISTANCE

in the new U. S. Royal Master High Voltage Power Cable

***Amazingly* better than ANY of the 5 leading brands tested!**

Test A—Here, a sample of 5 KV unshielded U. S. Royal Master Power Cable was bent into a U-shape, roughly 8 times its overall diameter. Placed upright on a grounded metal plate, a conductor-to-plate potential of 40,000 volts was applied. Because of this high test potential, the air broke down—and ozone cracks appeared. All 5 competitive cables failed within 20 minutes to 35 hours. The U. S. Cable was still going strong after 3400 hours! That's *real* ozone-resistance!

Test B—A sample of the new U. S. B-18 ozone-resistant neoprene jacket was stretched 200% of its original length, clamped in a metal rack, and put in an ozone chamber... where the ozone concentration was adjusted to .025% to .030% volume. Five other competitive jackets taken from leading brands were likewise placed in the chamber. Within 2 and a half hours, all jackets had failed—EXCEPT "U. S." This jacket sample did not fail until after 18 hours' exposure!

For full facts about the great high-voltage cable, call your nearest United States Rubber Company District Sales Office or write to address below. A representative will arrange to conclusively prove these facts.

US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

The Ansul dry chemical fire equipment pictured above includes portable hand units, wheeled and stationary units and a jeep installation. Ansul also manufactures automatic dry chemical piped systems, custom engineered for the hazard. Ansul equipment is listed and approved by Underwriters' and Factory Mutual Laboratories.

Only Ansul offers a Five Year Equipment Warranty

Your assurance of fast, dependable fire protection

For you, the buyer of fire equipment, Ansul's important 5 year warranty means many extra years of fast, dependable protection. It also means freedom from costly maintenance checks and repairs.

Special design and construction features make this warranty possible. Ansul's *weather-tight* construction keeps out moisture, resists corrosion. *Patented nozzles* deliver the right kind of stream for your hazard. A *sealed pressure cartridge* puts Ansul's "Plus Fifty" dry chemical to work immediately—no delay or lag. Finally, *rugged construction* makes it possible for Ansul equipment to give peak performance under the toughest operating conditions.

Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Division, Dept. F-153 Marinette, Wisconsin. *Write Ansul for your copy of new Fire Equipment Catalog.*

ANSUL

You can pull these plugs at full load . . . SAFELY!

Circuit-Breaking Arktite

PLUGS AND RECEPTACLES

20 amp. to 400 amp.—250V D.C.; 600V A.C.

SAFE at all times—even if you pull an *Arktite* plug to disconnect an energized motor or appliance in an emergency!

You don't have to open the disconnect switch before withdrawing an *Arktite*. Arcs created as line and load poles disengage are confined in deep, insulated arcing chambers—are instantly snuffed out by pressure-deionization and lack of oxygen. There's no possible danger of flashover injuring personnel or destroying property.

Contact your Crouse-Hinds Distributor, nearest Crouse-Hinds Office or Representative for complete information.

NEW, Re-Designed *Arktites* . . .

Feature new pressure connectors — new easier-to-wire 1-piece interior assemblies — new easier-to-interchange plug and receptacle interiors — new plug adaptability to any type and size cable.

Fully interchangeable with older style. Same price. Currently available in 30 and 60 amp. sizes, in 2-, 3- and 4-poles.

Operated like a giant switchboard, this *Arktite* installation with variations in power, frequencies and voltages is used to speed up machine tool testing. Plugs can be inserted and withdrawn from "live" receptacles without using a disconnect switch.

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y.

OFFICES: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Memphis, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Washington. RESIDENT REPRESENTATIVES: Albany, Atlanta, Baltimore, Baton Rouge, Charlotte, Chattanooga, Corpus Christi, Reading, Pa., Richmond, Va., Shreveport. Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

COMPARE

this dial switch

with any other

See why you get long operating life

This photo shows the rugged construction features of the dial switch from a *Quick-Break* mechanism of an Allis-Chalmers distribution regulator. See the extras: wired boltheads, oversize contacts, and extra-heavy backup springs on the moving contacts that make contact pressure so strong you can't pull contacts apart.

Moreover, the *Quick-Break* mechanism is simple. Its small number of parts make it easy to assemble and align. As a result, mechanical strength and reliability are at a maximum. Yet you get more extras — like *two* main drive springs—one for driving . . . one for snubbing.

This tap-changing mechanism is the heart of every Allis-Chalmers voltage regulator. Its record speaks for its outstanding reliability. More than twenty years of successful, unexcelled operation on thousands of regulator and load tap-changing transformers. One unit withstood more than five million tap changes during exhaustive laboratory tests.

Get the most for your regulation dollar. Facts on this and other quality features of Allis-Chalmers voltage regulators are available by calling your nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4736

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

ORIGINATORS OF 5/8% STEP REGULATION

IN ASA STANDARD RATINGS

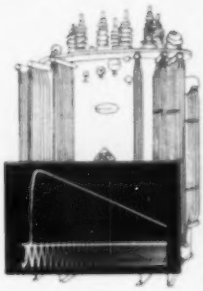
Here's News on

A-C ALLIS-CHALMERS

ALLIS-

Power Transformers

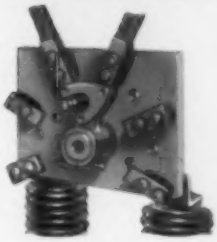
LOWER AND LIGHTER TRANSFORMERS are the result of new Allis-Chalmers designs. Installation is easier, transfer to new location simpler because higher rated units can now meet existing weight and height limitations. New shielding, improved insulation coordination, and use of cold-rolled oriented core steels have resulted in reduction of as much as 30 inches in overall height, reduction of as much as 25% of previous weights. Improved heat transfer increases overload capabilities.



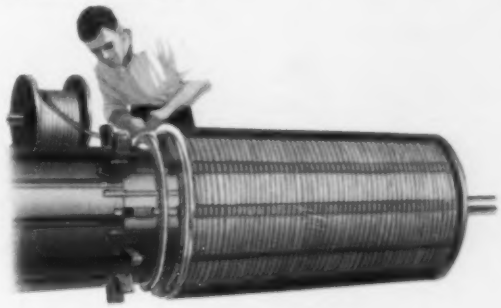
FULL WAVE IMPULSE TESTS of 100% Basic Impulse Level are now being made on most Allis-Chalmers power transformers. Results of this test program have helped make possible Allis-Chalmers corona-free design. Actual test values show that BIL and dielectric strength have been increased, resulting in additional margin of safety.

HV BUSHING REPLACEMENT SIMPLIFIED. New ASA standard HV bushings — 23 through 69 kv — are now being shipped. All bushings have standard mounting dimensions and standard shank lengths below flange, which makes interchange easy. Provision for power factor testing is available.

NEW POSITIVE SEAL LV BUSHINGS rated 8.7 and 15 kv offer advantages in installation, replacement, and stocking. Bushings can be replaced externally without removing transformer manhole cover. Gaskets under controlled compression eliminate all cemented parts. Original hardware can be re-used when replacing damaged porcelain. High degree of interchangeability is possible: the same porcelain is used on all current ratings; the same hardware used on both voltage classes.



DEPENDABLE TAP CHANGING provided by service-proved "point contact" mechanism. Excellent contact is assured by thorough wiping action. Combination of mechanical and magnetic pressures develops maximum contact pressure. Like all accessories, tap-changing mechanism is located for maximum convenience. Panels are vertically mounted on top of core and coil assembly to permit easy inspection and adjustment without untanking.



INCREASED MECHANICAL STRENGTH IN COILS results from no-splice, continuous disk winding. Turns are wound on pre-formed tubes with carefully controlled tension to insure a tight coil. Coils are magnetically balanced to prevent high short-circuit stresses. To assure proper coil ventilation, each conductor is exposed to cooling oil. Special snap-lock spacers, keyed in place between coils, form uniform cooling ducts. Particular attention is paid to lining up spacers to obtain maximum coil rigidity.

NEW WELDED-ON SWAGED TUBE RADIATORS provide effective cooling. They eliminate handling radiators and oil as separate shipping items, simplify installation and maintenance. Radiator tubes are shaped to minimize vibration and contribute to a quiet transformer — another result of Allis-Chalmers extensive sound research program.

CHALMERS

FOR MORE INFORMATION
see your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for new catalog on "Preferred Power Transformers," 2842.

A-6734

Pneu-Draulic Operators Prove Dependability ...Low Maintenance

The *Pneu-Draulic* operator is in use on Allis-Chalmers breakers in many parts of the country. Its planned simplicity and reliability have led to quick and widespread acceptance.

Here are a few advantages of this operating mechanism:

★ **Dust** eliminated by virtual sealing of system.

★ **Corrosion** eliminated because oil in the system contains one of the best corrosion inhibitors known.

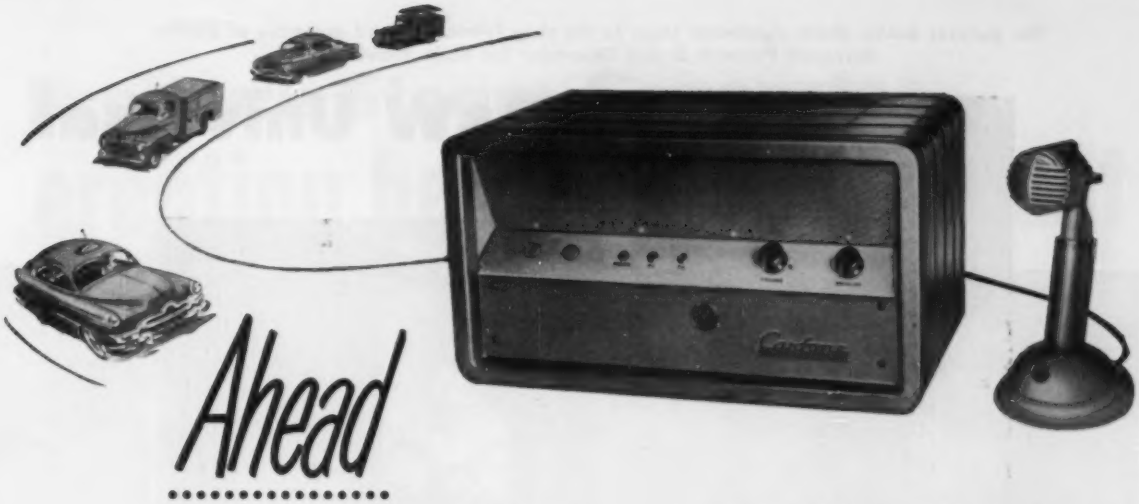
★ **Moisture** problems eliminated, since the system is filled with oil.

Get complete information on the *Pneu-Draulic* operator and the Allis-Chalmers breaker. Call your nearby A-C office, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 71B7942.

A-4524

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS



Ahead

...in Styling!...in Performance!

New RCA Carfone ONE FIFTY 2-Way Radio

Performance-wise, as well as appearance-wise, this is the finest 2-way radio equipment that RCA has ever offered. Engineered for top performance, clearest voice reception, minimum maintenance and low-cost servicing, its features represent planning that is years ahead.

Among the built-in advantages you'll welcome now and benefit from in the years to come . . .

IN THE DESK STATION

- Styled for convenience
- Best frequency stability, without ovens
- Rainbow Tuning—color directed, all top adjustments
- Dual frequency operation, if needed
- Full coverage of 148-174 mc—without change of components

IN THE MOBILE UNIT

- Complete 6-12 volt convertibility
- Best frequency stability, without ovens
- Fewest tube types and fewest tubes
- Single Vibrator power supply
- Sealed Selectivity
- Most compact

"Get the Best!"

RCA DISPATCHER 2-WAY RADIO TO DRIVER

MAIL COUPON BELOW FOR MORE DETAILS

RCA

RADIO CORPORATION of AMERICA

COMMUNICATIONS EQUIPMENT CAMDEN, N.J.

Radio Corporation of America
Communications Equipment
Dept. XC-45, Building 15-1, Camden, N.J.

Please send me information on the new RCA Carfone "150" 2-Way Radio.

NAME _____

TITLE _____

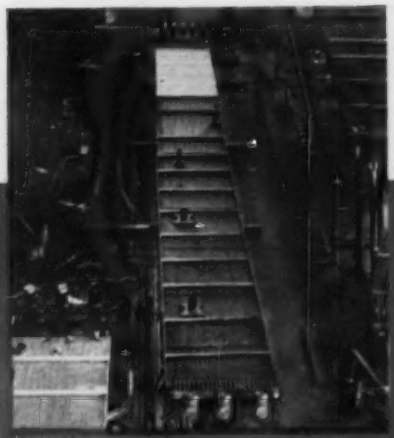
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

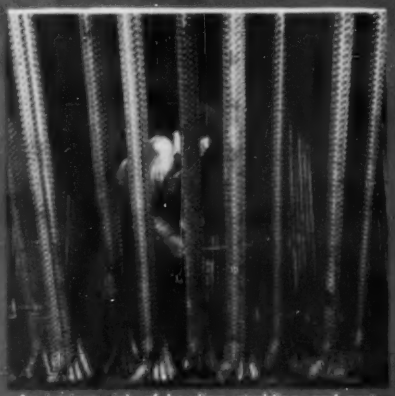
The pictures below show significant steps in the shop fabrication and assembly of B&W's Universal Pressure Steam Generator for Philo Plant.

B&W Universal



Assembly, complete and ready for shipment, of the second pass side wall is about 55 feet long, 5 feet, 6 inches wide. Alloy tubes are strength welded into the headers.

Floor tubes for secondary front wall assembly are carefully inspected for correct alignment.



An intricate job of bending, studding, and nesting characterizes the screen and floor for the secondary front wall.

Support castings being welded on flexible, small diameter tubes for roof assembly. Note that each tube end has a steel plug in it for cleanliness and future hydrostatic tests.

Shop assembly of secondary front wall. Note assembly frame which was made of plates and pipes welded together, but was not attached physically to the tube assembly at any point.

Secondary front wall section of alloy tubes and headers on its way to be completely stress relieved after assembly.

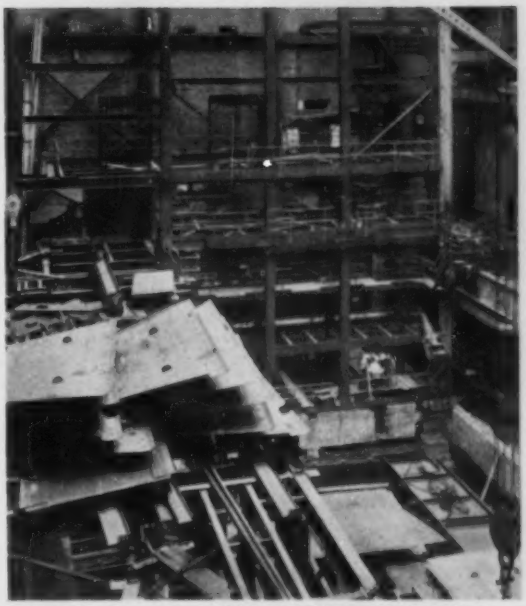
Pressure Steam Generator erection begins at Philo Plant

Final field erection has started on the world's first commercial supercritical pressure steam generator. At the Philo Plant of the Ohio Power Company, on the American Gas and Electric System, shop-assembled components of B&W's Universal Pressure Steam Generator are now being erected. It will supply steam at 4500 psi, 1150 F to a 125,000-kw turbine, and there will be two stages of reheat. Expected net heat rate is 8500 Btu per kilowatt hour.

The complete installation at Philo Plant represents a new break-through in steam electric generating efficiency. In the words of Phillip Sporn, President of American Gas and Electric Service Corp.:

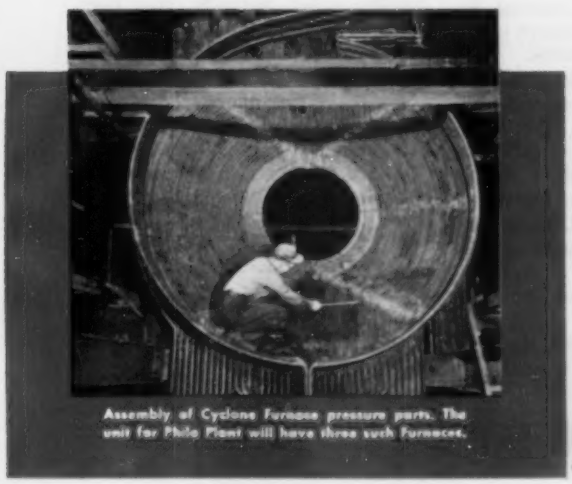
"The Philo project reflects the outstandingly dynamic character of the electric power industry. Here, in the very important field of energy generation, new frontiers are being pushed forward. Here, new avenues of approach to improvement in capital costs, in efficiency and in operating costs, are being opened. And, in keeping with the tradition that has characterized the growth and development of the industry, the results of this pioneering achievement will be made available to the rest of the industry.

"The electric power industry, far from challenging any particular method of generating energy, demonstrates by this Philo project its readiness to adopt and bring forward every new development that can advance its technical and economic well being."



Start of boiler erection at Ohio Power Company's Philo Plant.

Sectional View of B&W Universal Pressure Steam Generator.

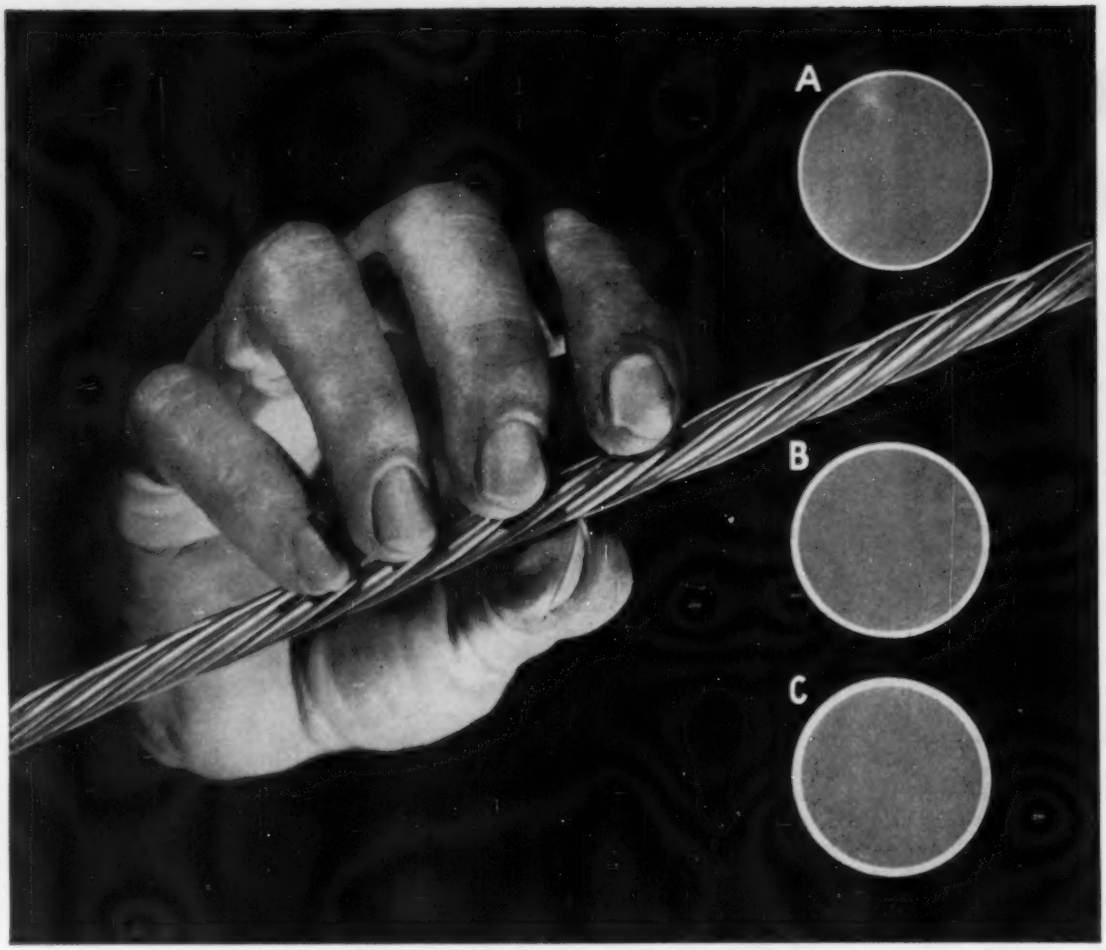


Assembly of Cyclone Furnace pressure parts. The unit for Philo Plant will have three such Furnaces.

G-730

BABCOCK & WILCOX

BOILER DIVISION



Strand Lives Longer When Rust Stays Out

The life-span of your strand depends heavily upon the coating that shields the ferrous wires. The better this jacket holds up, the less chance there is for rust to gain a foothold. That's why Bethlehem went all out, nearly 20 years ago, to develop a coating that would really *protect* against rust.

The development work resulted in the *bethanized* coating, which has stood the test of time.

Applied electrolytically, this zinc armor is so pure, so uniform and ductile, that it will not crack or peel even under repeated bending. It offers no tiny crevices or "checks" in which rust can get started. It keeps corrosive atmosphere completely away from the wires.

But there's another big advantage to specifying Bethlehem strand with the bethanized coating. This coating is available in three different weights, making possible a choice for every field condition. The lightest, coating A, is the thickness of extra-galvanized. Coating B is twice as thick as A; coating C, three times as thick as A. All meet standard ASTM specifications.

For the long-term jobs, the two heavier coatings are especially recommended. Actually, they cost little more than the A-weight; but under parallel conditions they last much longer. They're a real "buy."

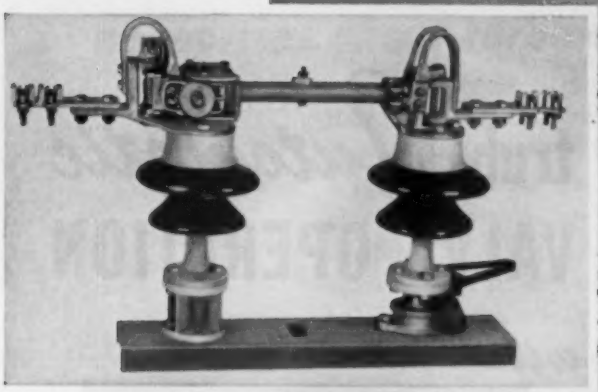
Full details about Bethlehem strand are available at our nearest sales office. If you will call or write us, we'll gladly see that you receive complete information.

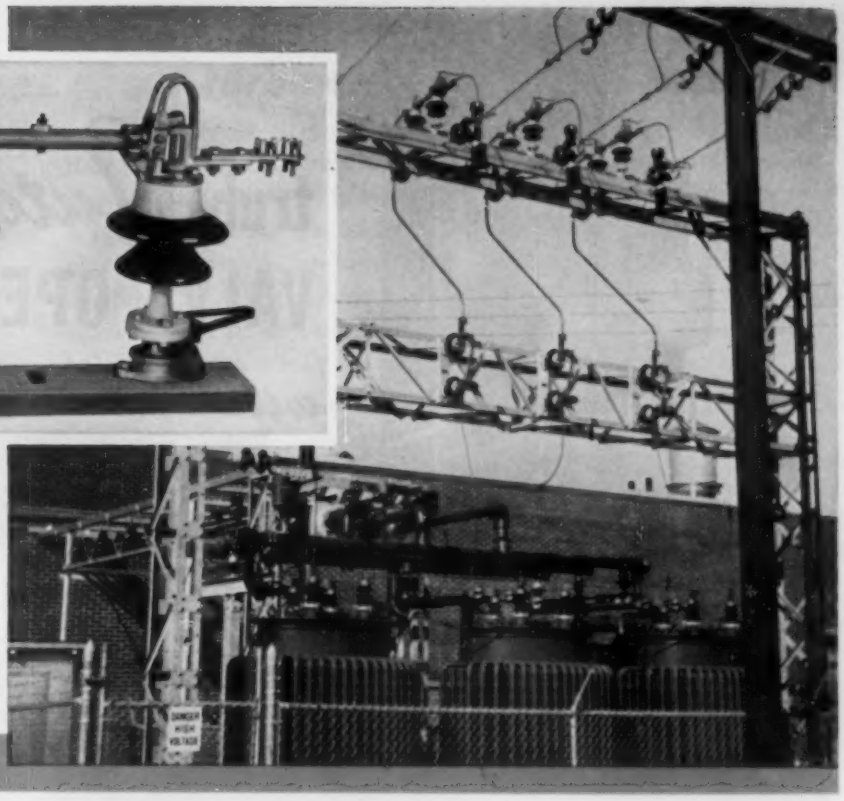
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL





Southern States' Type 57-K Group Operated Air Break Switches are used in this modern Shelbyville, Tennessee, plant. Self-adjusting line contacts maintain high-pressure permanently. Non-corrosive, greaseless bearings and a minimum of moving parts keep maintenance low. Available in voltage ratings from 7.5—69kv and continuous current ratings from 400—1200 amps. For details, ask for Bulletin 5457K.

U.S. RUBBER IS GOOD EXAMPLE OF HOW NATION'S INDUSTRIES USE SOUTHERN STATES EQUIPMENT

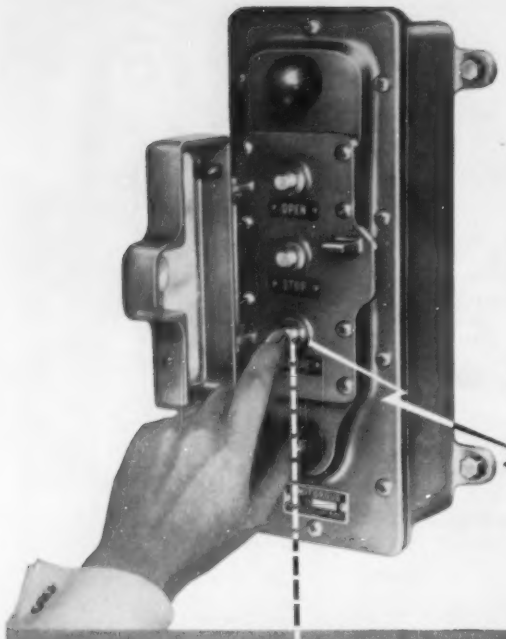
Increased use of power by the nation's expanding industries is calling for more substations and switchyards. Southern States is ideally equipped to handle these applications to the complete satisfaction of industries and suppliers of power alike.

A Shelbyville Power System industrial substation at the U. S. Rubber Co. Plant in Shelbyville, Tennessee, is a good example. Southern States supplied the substation and many components: the type 57-K Group Operated Air Break Switches for disconnecting incoming 15 kv lines; B Series Power Fuses to protect the transformers; connectors and bus fittings which accommodate conductors carrying up to 3500 amps; and heavy-duty, hookstick operated disconnects that provide a means for isolating the station from the plant.

Industries, as well as the nation's leading utilities, look to Southern States for top-quality, functional equipment. It will pay you to specify products made by Southern States.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



truly *Automatic* VALVE OPERATION *with* Limitorque®

"just press the button"

Think of the time, labor and money that can be saved by opening and closing valves in remote, inaccessible or distant locations with LimiTorque . . . automatically, from a centrally located control panel. LimiTorque not only operates valves at the speed required, but it "limits the torque" applied to the valve operating parts and thus prevents damage to stems, seats, discs or gates . . . and too, the handwheel "cannot rotate" when the valve is being motor-operated. LimiTorque may be actuated by any available power source; such as electricity, gas, steam, water, oil or air—and is readily adapted for Microwave Control. Thousands of these units are being used in Power Plants, Oil Refineries and Pipe Lines, Water and Sewage Plants, Chemical Plants, Pulp and Paper Mills, and on Shipboard.

The above is a Type SMA-000 LimiTorque for operating smaller valves. There's a type and size of LimiTorque for every valve operating need.

Send for Catalog L-54, and be convinced.

PHILADELPHIA GEAR WORKS
INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
LimiTorque Corporation—Philadelphia
Industrial Gears & Speed Reducers • LimiTorque Valve Controls
ESTABLISHED 1892

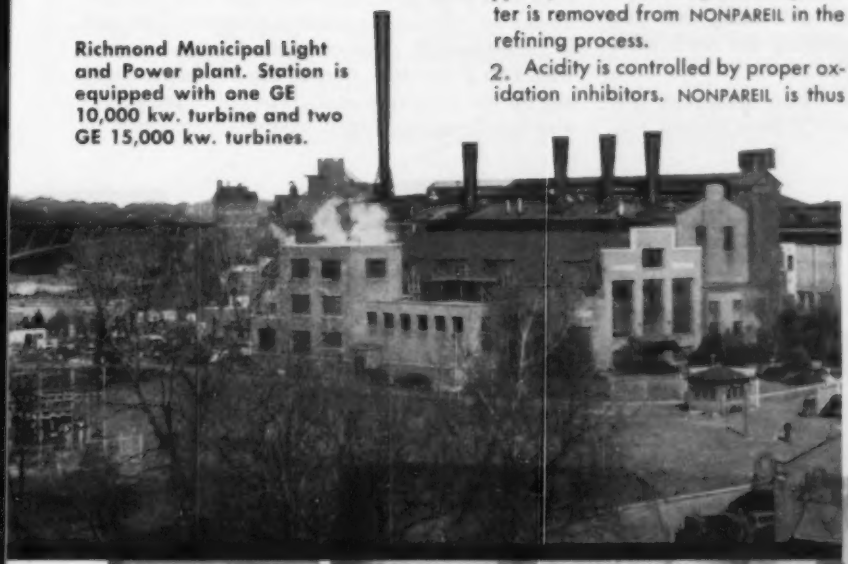
NONPAREIL *in service 21 years— no worries about turbine oil failure at Richmond*

Richmond, Indiana, Municipal Light and Power plant, first installed NONPAREIL Turbine Oil in two GE turbines in 1934. One turbine is 10,000 kw., the other 15,000 kw. The same NONPAREIL Turbine Oil—plus usual makeup—has been in service in these turbines ever since. Another 15,000 kw. turbine installed in 1948 has also used NONPAREIL since start up. In each unit NONPAREIL has lived up to its guarantee to last for however long the turbines are in service.

NONPAREIL Turbine Oil can deliver this outstanding service because:

1. Asphaltene or sludge forming matter is removed from NONPAREIL in the refining process.
2. Acidity is controlled by proper oxidation inhibitors. NONPAREIL is thus guaranteed never to exceed an acidity level of 0.15 mg. KOH/g. In most cases oil acidity is maintained at levels near 0.05 mg. KOH/g.

Want to know more about NONPAREIL Turbine Oil? In the Midwest, call your nearby Standard Oil office. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Ill.



Richmond Municipal Light and Power plant. Station is equipped with one GE 10,000 kw. turbine and two GE 15,000 kw. turbines.

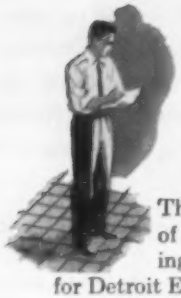
NONPAREIL Turbine Oil has lived up to guarantee for 21 years in two turbines at Richmond, Indiana. Another turbine has used NONPAREIL 7 years.

STANDARD

STANDARD OIL COMPANY (Indiana)

300,000-Kw Steam Turbine Generator

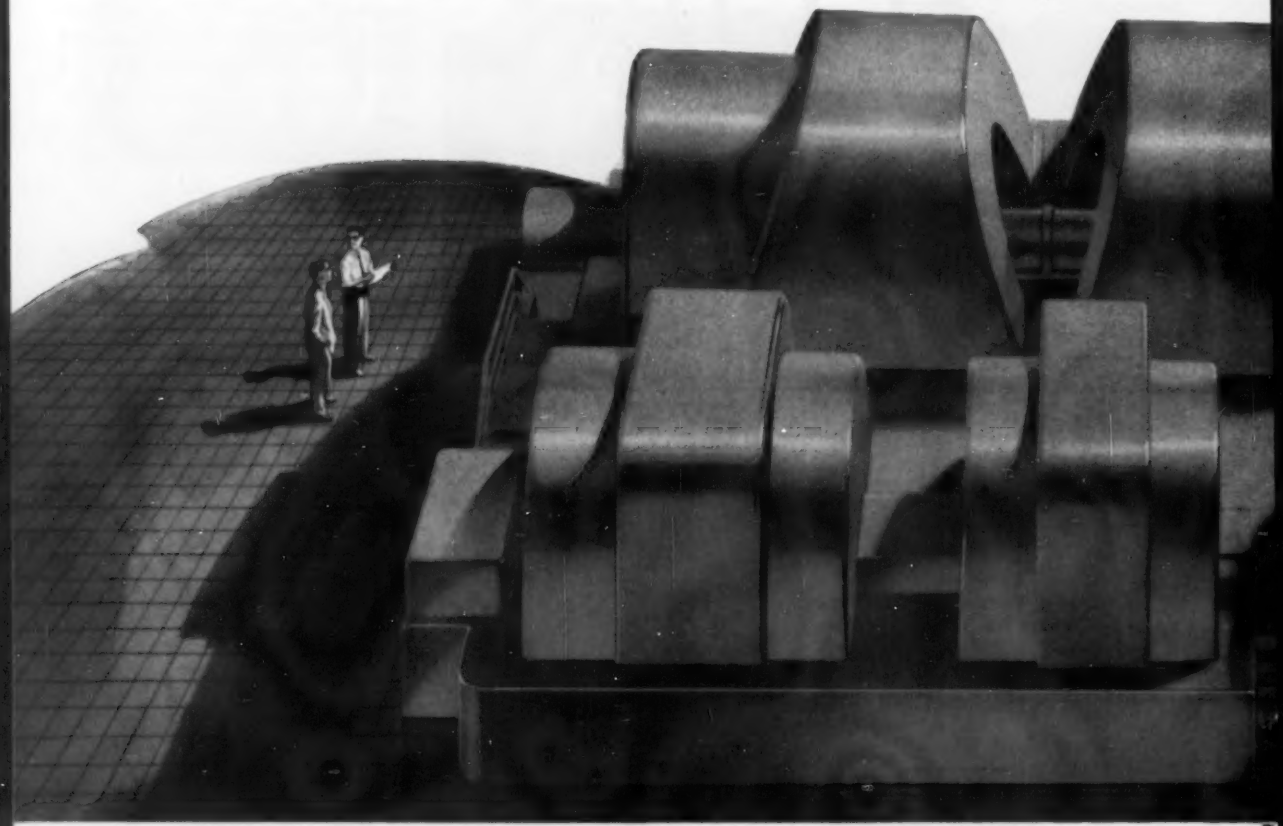
New In Power



The illustration below shows a model of a 300,000-kw steam turbine generating unit being built by Allis-Chalmers for Detroit Edison. Its capacity is far higher than that of any steam turbine generating unit yet built. It is capable of supplying the needs of a city of half a million people.

When this new unit goes into operation, the total capacity of the Detroit Edison system will be more than 3¼ million kilowatts — double the system's capacity of ten years ago.

Many features of this unit are examples of Allis-Chalmers developments that help utilities keep pace with our expanding economy. The unit is close-coupled, cross-compound reheat design, with two generators, one on the 3600-rpm shaft, one on the 1800-rpm shaft. The 3600-rpm generator is fully supercharged, taking advantage of an



A-C

ALLIS-

Paces Utility Progress

Era Generation

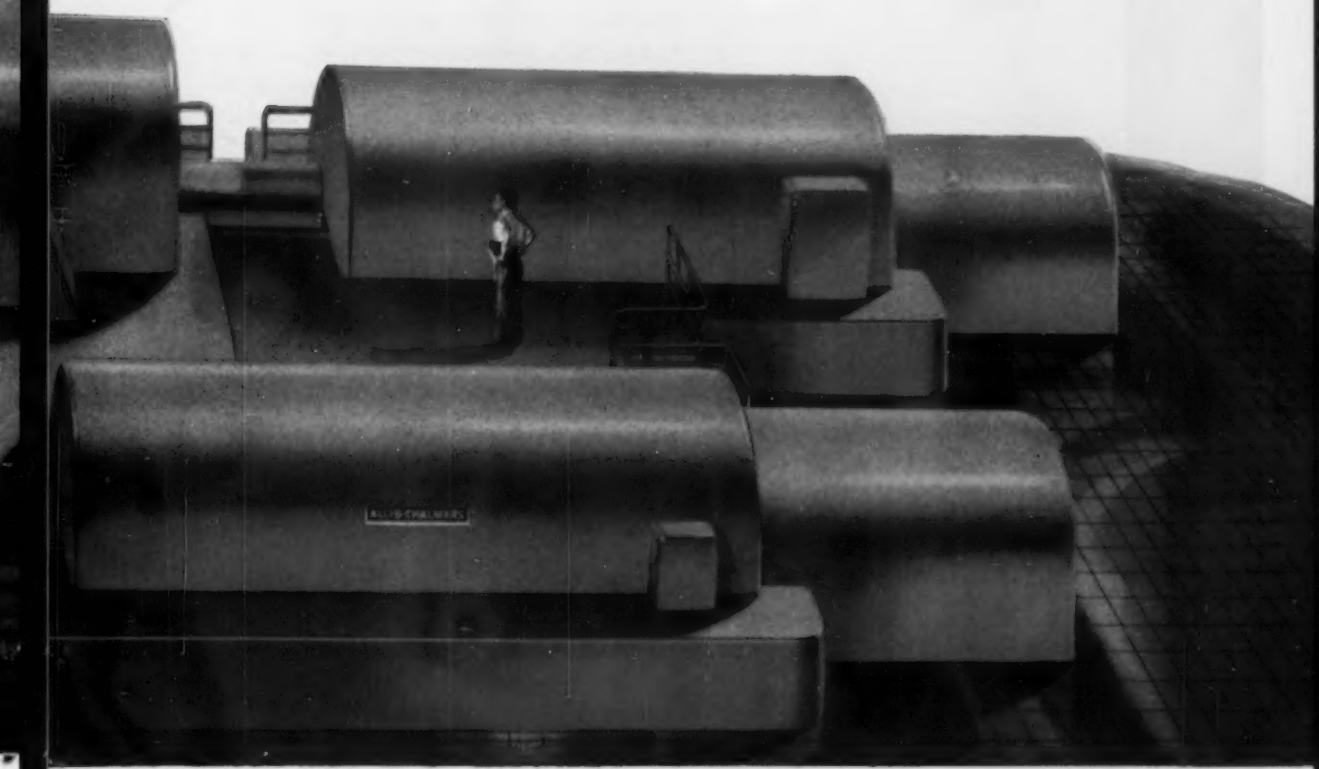
Allis-Chalmers development that makes possible higher capacities and smaller relative sizes.

The fully supercharged 3600-rpm generator is rated 206,470 kva, 0.85 power factor, 0.80 short circuit ratio, at rated hydrogen pressure. The 1800-rpm generator is a conventional hydrogen-cooled machine that is rated 171,765 kva, 0.85 power factor, 0.80 short circuit ratio, at rated hydrogen pressure. Operating steam conditions are 2400 psig, 1050 F at inlet; 1000 F reheat; and 1 inch Hg absolute exhaust pressure.

* * *

If you would like more information on Allis-Chalmers steam turbine generating unit developments, your nearby Allis-Chalmers office will be glad to arrange a discussion at your convenience. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4794



CHALMERS

BUSGEAR

CO-ORDINATED ELECTRICAL SYSTEMS OF BUSWAY and SWITCHGEAR

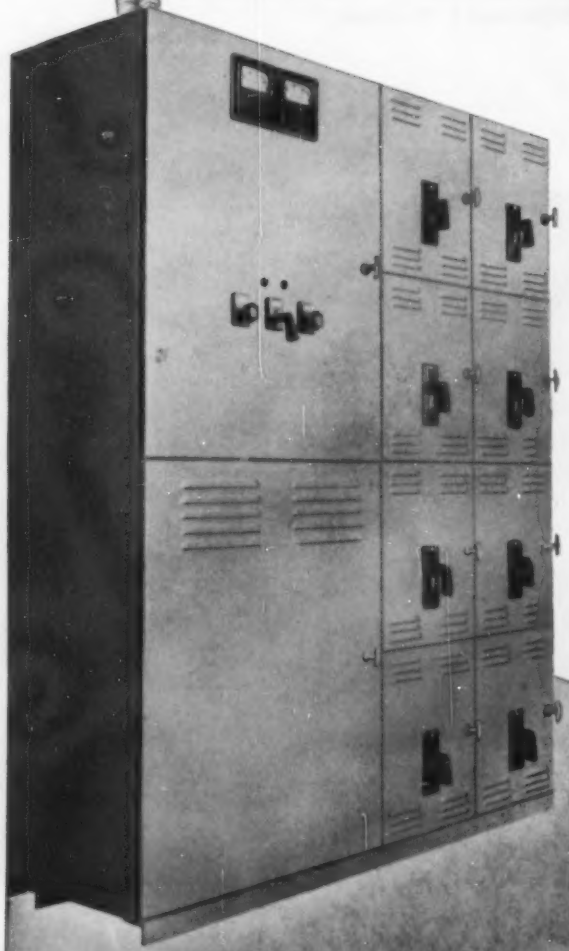
In modern industrial and commercial buildings, there are two major components of electrical distribution systems, *bus*way and switch*gear*.

Uni-Bus busway provides a new concept in electrical distribution. Industrial and commercial installations are more flexible, safer and truly economical with the new Uni-Bus busways.

For numerous tap-offs, as in industrial plants, the Uni-Bus plug-in system is ideal. To carry current from one point to another with only a few tap-offs, as in lighting risers in office buildings, the Uni-Bus feeder system is most economical.

To obtain maximum efficiency from the Uni-Bus system, co-ordinated overload and short-circuit protection is essential. This is accomplished best with Roller-Smith switchgear expressly designed with that aim in view. Extensive testing at Roller-Smith is the basis for sound engineering co-ordination between Uni-Bus *bus*way and switch*gear*.

That's why we selected the name BUSGEAR to identify the completely co-ordinated system manufactured by Roller-Smith under *one* roof and under the supervision of *one* Engineering Department.



Roller-Smith
CORPORATION
BUSWAY and SWITCHGEAR
BETHLEHEM, PENNSYLVANIA

How USS COR-TEN Steel

- *will lengthen hardware life*
- *cut replacement costs*

This booklet tells the story

If you'd like to find out how a few extra cents spent for COR-TEN Steel pole line hardware will save many dollars in replacement costs, send for a copy of this new, free booklet.

It fully explains why corrosion-resisting, high strength USS COR-TEN Steel offers the logical—and most economical—means of obtaining the highly desirable goal of *equal service life for hardware and pole.*

This booklet contains a treatise on the subject of corrosion from the standpoint of the user or owner of the pole line hardware – discussing the aspects of base metals, oxide characteristics, protective coatings, and the effects of various types of atmospheres. It well deserves your careful and thoughtful consideration. For your copy write to United States Steel Corporation, Room 4889, 525 William Penn Place, Pittsburgh 19, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS COR-TEN High Strength STEEL

USS

S-1662

UNITED STATES STEEL

SELLS 100 AMP SERVICE—

This "spread" works hard at promoting AW for both the modernization and new home markets. Impresses contractor with importance of continually selling AW on all fronts—and of cooperating with local AW drives.

METER MOUNTINGS FOR 100 AMP AND LARGER SERVICES—

Booklet describes Murray's full line of 100 Amp equipment including the most complete line of Meter Mounting equipment available for residential and light commercial installations.

HELPFUL HOME WIRING CHART—

This valuable check chart worked out in collaboration with leading contractors and AW experts helps contractors plan and install more adequately wired home electrical systems.

More ACTION on the "Adequate Wiring" Front!

THE three "spreads" you see here are from Murray's new 12-page 100 Amp Booklet. An important element in Murray's national 100 Amp Campaign, this booklet is designed to promote 100 Amp Service to electrical contractors in your area—and through them—to your homeowner-customers.

Copies are available to you absolutely *free* to supplement your own Adequate Wiring drives. Informative and helpful, you'll want to consider the booklet's use by contractors, architects, and builders in your area.

Let us know what your requirements are and we will fill them. No obligation whatever! Simply write Murray Manufacturing Corp., Dept. EW-3, 1250 Atlantic Ave., Brooklyn 16, N. Y.

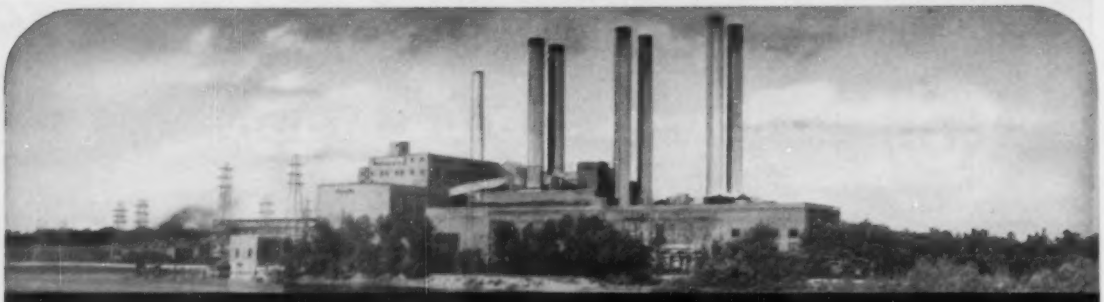
"Quality doesn't cost . . . it pays!"

Murray

Safety Switches • Service Entrance •
Fuse Panels • Meter Mountings • Load Centers
Magnetic-Hydraulic Circuit Breakers

IN CANADA: MURRAY ELEC. MFG. CORP. (CANADA) LTD. TORONTO, ONTARIO

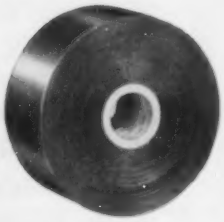
Once in a Blue Moon
you'll need a
new Power Plant
. . . then Pioneer Service & Engineering Co. with 53 years of experience in this specialized field, stands ready to help you with a complete service including preliminary plans, load studies and site selection, the design of the plant and arrangements for financing its cost.
Our services and facilities are outlined in our booklet, "Pioneering New Horizons" yours for the asking.
53 YEARS
Pioneer Service & Engineering Co.
231 SOUTH LA SALLE STREET • CHICAGO 4, ILLINOIS
Consulting Engineering • Power Plant Design
Purchasing and Expediting • Financial Advisory Service
Forecast, Load Study and Performance Analysis
Stock Transfer and Dividend Disbursement
Valuation, Insurance, Rate and Business Advisory Service



Power-plant problems solved right here:

INSULATING? Solve it with "SCOTCH" Brand Plastic Electrical Tapes! Plastic backing resists weathering and sunlight, acids, oils, alkalies and water. Widely used for splicing and insulating. Three thicknesses: 7 mils (No. 33), 10 mils (No. 22), 20 mils (No. 21).

PADDING? Solve it with "SCOTCHFIL" Electrical Insulating Putty! Comes in a 1½ in. x 5 ft. roll, applies like tape. Easily moulded as padding for bus bars, odd-shaped terminals and fittings. Excellent cable build-up for splicing. Gives smooth taping surface.



CORROSION? Solve it with "SCOTCHRAP" Pipe Insulation Tape! It's a tough polyvinyl chloride film with a pressure-sensitive adhesive. Resists abrasion, galvanic and electrolytic action on buried pipe. Two thicknesses: 10 mils (No. 50), 20 mils (No. 51).

SPLICING? Solve it with "SCOTCHLOK" Electrical Spring Connectors! Steel spring construction grips the wires tight—actually *threads* the wires for extra-strong hold. "SCOTCHLOKS" never shake loose! Four sizes for wire gages from 18 AWG to 2 AWG.

HIGH HEAT? Solve it with "SCOTCH" Brand Electrical Tape No. 27! Glass cloth backing won't burn. Thermosetting adhesive cures to form a permanent bond of great strength. Ideal for insulating and splicing wherever high heat is a problem. ½ in. x 66 ft. rolls.

SEALING? Solve it with "SCOTCHCAST" Resin No. 4 in the "UNIPAK" Container. Premeasured resin and activator are mixed by squeezing "UNIPAK" envelope. For cable splicing, sealing fittings against dust, moisture, explosive atmosphere.

Reg. U.S. Pat. Off.

SCOTCH BRAND Electrical Products

The term "SCOTCH" and the plaid design are registered trademarks of Minnesota Mining and Manufacturing Company, St. Paul 6, Minn. Export Sales Office: 99 Park Avenue, New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

3M

SUBSTATION STRUCTURES

One Responsibility
FROM DESIGN TO DELIVERY!

INDUSTRIAL INSTALLATION

R&IE

CENTRALIZED SUBSTATION SERVICE

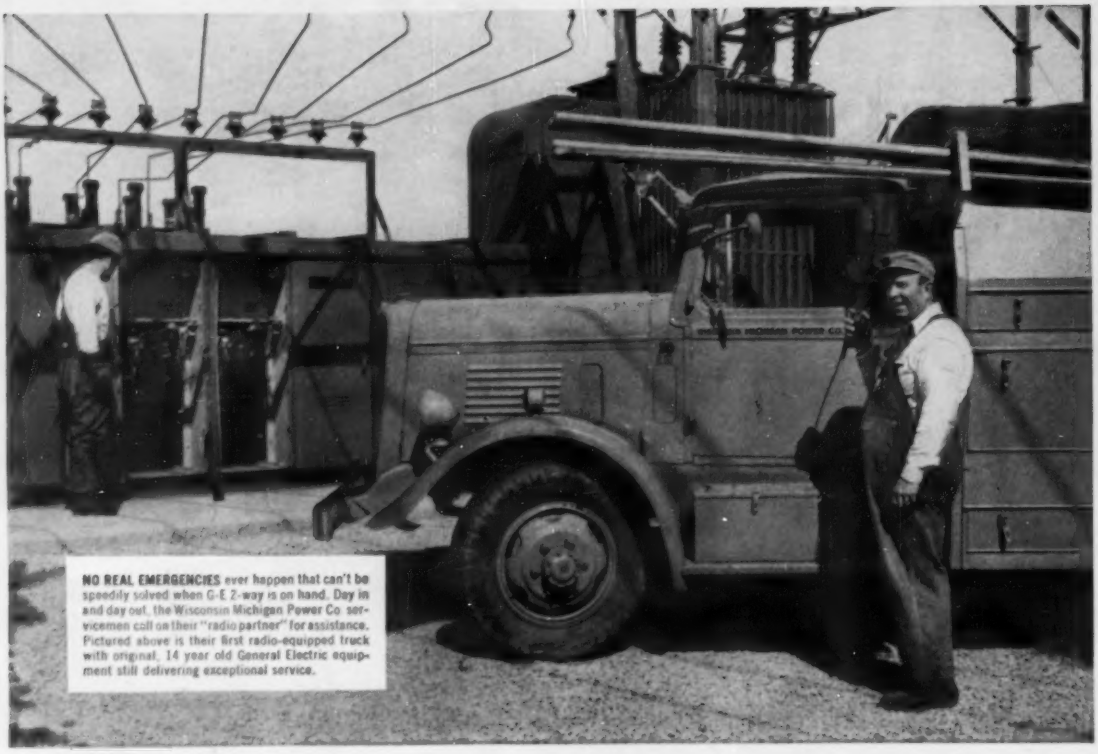
Check the facts!

1. **DESIGN** layout, detail complete.
2. **FABRICATION** complete in R&IE shop.
3. **GALVANIZING**—new controlled methods.
4. **SWITCH ASSEMBLY** — from foundry and all machining operations, R&IE controls the entire manufacture ready for delivery.
5. **VERSATILITY** to solve any special problem. Illustration shows typical industrial application of R&IE design.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION



NO REAL EMERGENCIES ever happen that can't be speedily solved when G-E 2-way is on hand. Day in and day out, the Wisconsin Michigan Power Co. servicemen call on their "radio partner" for assistance. Pictured above is their first radio-equipped truck with original, 14 year old General Electric equipment still delivering exceptional service.

"LONG TERM PERFORMANCE RECORD PROVES G-E OUR BEST INVESTMENT!"

2-WAY MOBILE RADIO

FREQUENCY STABILITY & SELECTIVITY
guaranteed for life!

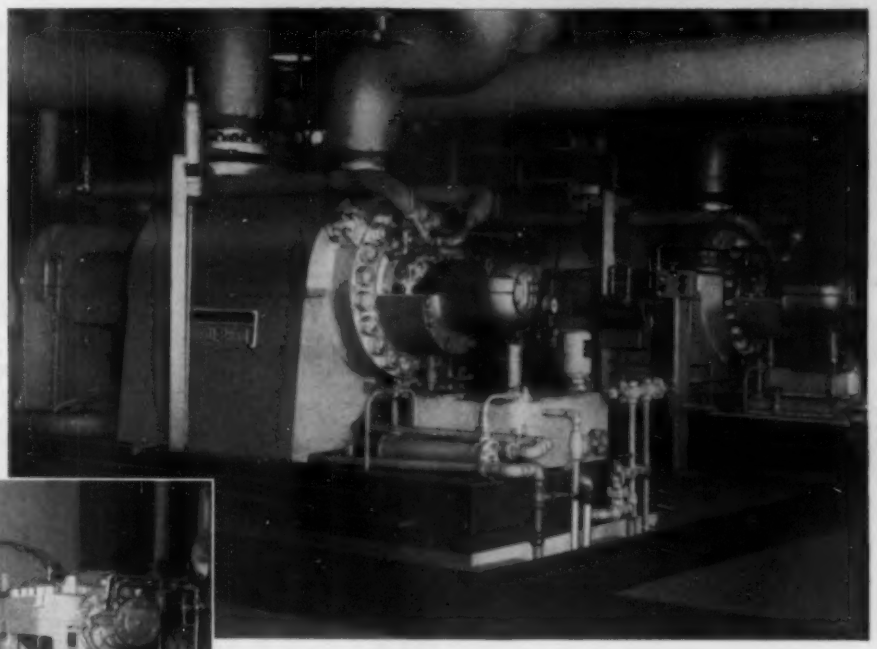
THAT's how an expert rates G-E 2-way radio! H. H. Brown, Chief Electrical Engineer, at Wisconsin Michigan Power Company, supports this high appraisal with the testimony of 14 years' service. The original installation in 1941 consisted of one 250-watt fixed station and three 30-watt mobiles. "Today, only one of these mobiles has been retired and we've *expanded with General Electric* to four fixed stations and 61 mobile units servicing two divisions."

Examine the advantages G-E 2-way offers and you'll quickly understand why it is *the preferred communication among utilities.* Get all the facts on G-E and then plan expansion. Ask your local Communications Counselor about the new "guarantee program" or, write: *General Electric Co., Section X19105-17, Electronics Park, Syracuse, New York.*

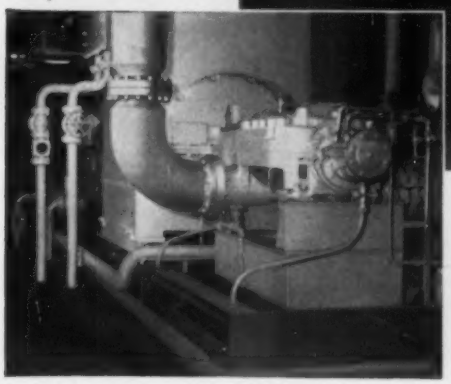
Progress Is Our Most Important Product

GENERAL ELECTRIC

UTAH POWER & LIGHT COMPANY'S MODERN GADSBY PLANT



Six-inch, 7-stage CHTA secondary boiler feed pump serving the #2 reheat section at the Gadsby Plant.



Six-inch, 5-stage HMTA primary boiler feed pump, tandem mounted with the CHTA pump shown above.

Uses two Ingersoll-Rand Boiler Feed Pump Sets on new 75,000 KW Reheat Unit

Utah Power & Light's Gadsby Plant recently put into operation its second unit, incorporating reheat design and increased pressure and temperature. The additional 75,000 kw thus made available will help meet the region's industrial demand which has trebled in the last seven years.

In keeping with the high efficiency and economy of reheat design, Utah Power & Light engineers specified Ingersoll-Rand CHTA and HMTA boiler feed pumps. Two pump sets, each consisting of one HMTA primary pump and one CHTA secondary pump, tandem mounted, serve unit #2. The six-inch, 5-stage HMTA primary pumps, handling 230° F water at 45 psi, discharge to the low pressure heaters at 920 psi. The six-inch, 7-stage CHTA "double case" secondary pumps receive 500° F water at 850 psi and deliver 1785 gpm at 2000 psi.

Ingersoll-Rand two-pump boiler feed sets also are used on the plant's original 66,000 kw unit.

Ingersoll-Rand is a principal supplier of dependable boiler feed pumps to the power industry. Your nearby I-R representative will be happy to give you complete information.

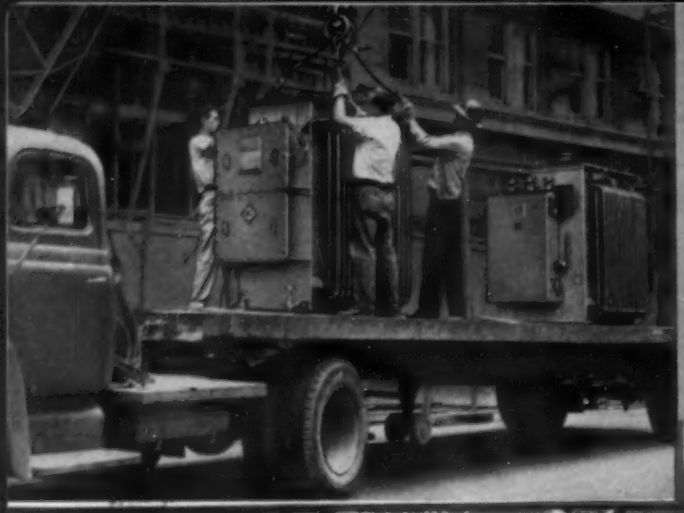
Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

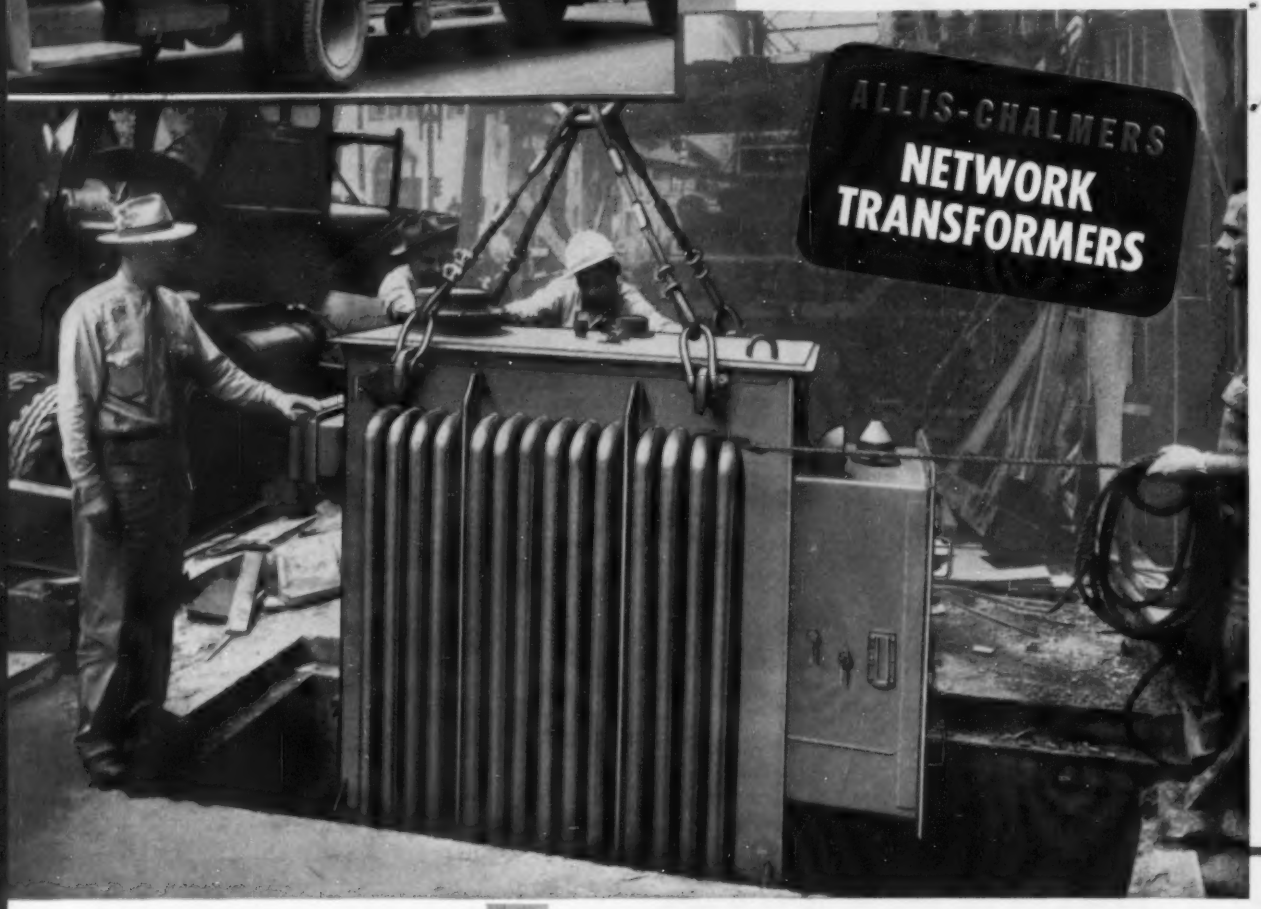
969-10

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • AIR & ELECTRIC TOOLS • ROCK DRILLS

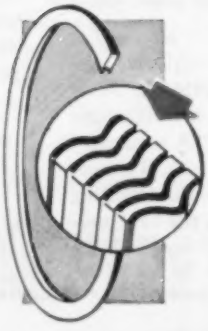
Tight



Transformers are unloaded from PG&E truck in front of partially finished building at northeast corner of busy Montgomery and Sutter Streets in San Francisco.



Transformer is lowered into much smaller than normal vault. Other three units went into same size vault close by. Low voltages are tied in with PG&E's secondary network system.

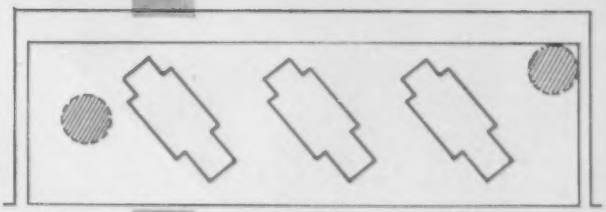


Spiral-wound gaskets. Over 6 years' continual use has proved their superiority over other types of gasketing material for sealing bushings in the tank wall. Alternate plies of preformed spring-like metal and non-metallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cement or grease. They can be quickly removed as required and may be re-used if necessary.

Squeeze in San Francisco

Compact

network transformers and engineering ingenuity solve problem when vault is small



Sketch of vault shows how three 500-kva transformers were fitted into unusually small area.

PACIFIC GAS & ELECTRIC COMPANY'S network engineers had to test their ingenuity to provide power for the new Equitable Life Assurance Company building in San Francisco. It was a tight fit for transformers because building architects limited vault width.

PG&E engineers solved the problem by installing the units at a 45-degree angle. Even then it was a tight squeeze to get six 500-kva transformers in the space allowed.

For a job like this, compact design and reliable operation are vital. Not only must transformers fit into small size vaults, they have to provide trouble-free performance, because maintenance isn't easy.

PG&E used Allis-Chalmers network transformers for the job. These units have proved their reliability in hundreds of installations — over 1½ million kva are now in operation. They have the compact design and rugged construction needed for congested areas.

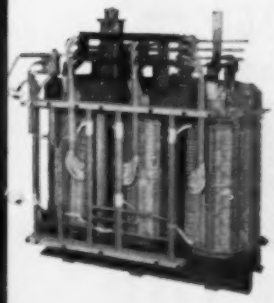
Before you consider your next network installation, get complete facts on Allis-Chalmers network transformers. Call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

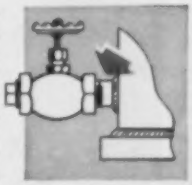
A-4711

Design and Construction Features



Compact, low-loss design. Thermal capacities are high for contingency load conditions. Sturdy, time-proved core and coil construction meets repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism. Handle inserted through two-inch opening on cover operates the tap-changing mechanism. Handle cannot be removed unless it is in positive tap change position.



Threaded valve connections to tank are tinned for extra protection. Valves are located for easy access. Globe-type valves with non-rotating seats close tight; avoid wear on valve seats.

NO FINER WRENCH ANYWHERE!

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional adjustable wrenches. Their chrome plate finish is as durable as it is handsome. Choose CRESTOLOY Wrenches for outstanding performance in the toughest kind of service. Sold by hardware dealers everywhere.

8 SIZES IN SINGLE & DOUBLE END TYPES

Number	Size	Capacity
AC14	4"	1/2"
AC16	6"	3/4"
AC18	8"	15/16"
AC110	10"	1-1/8"
AC112	12"	1-5/16"
AC115	15"	1-11/16"
AC118	18"	2-1/16"
AC124	24"	2-7/16"
BC146	same as 4" and 6" above	
BC168	" 6" " 8"	"
BC1810	" 8" " 10"	"
BC11012	" 10" " 12"	"

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Designed and built to specifications you might have written...

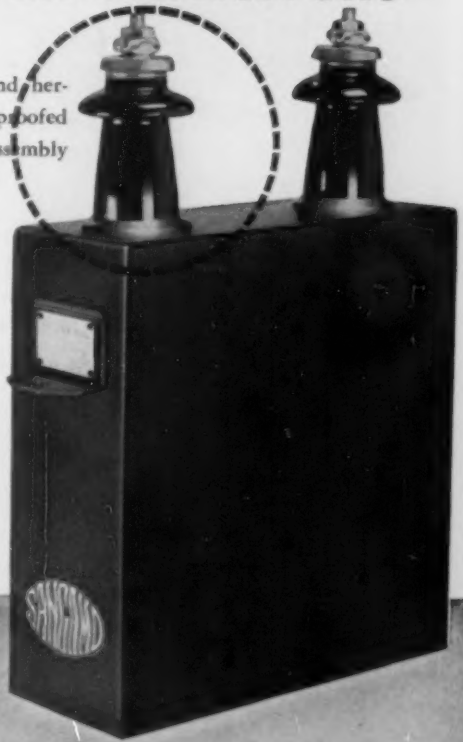
Power Capacitor Specifications
1. Corrosion protection - even though case finish is scratched.
2. Solder-sealed porcelain bushings.*
3. Reliable performance at low ambient temperature.
4. Suitable for vertical or horizontal mounting.
5. Low losses.
6. Low temperature rise.
7. Stability under all operating conditions.
8. Terminal connectors for either copper or aluminum.

SANGAMO POWER CAPACITORS

* This solder-to-porcelain bonding technique permanently and hermetically seals the all-weather porcelain bushing to corrosion-proofed metal fittings. Induction soldering then seals the bushing assembly directly to the case. The bond is so strong that the capacitor can be readily handled by its terminals without the slightest danger of disturbing the seals.

Some of the utility men we talked to particularly liked the idea of the Sangamo Capacitor's heavily tin-plated terminal parts. This tin-plating practically does away with corrosion problems with either copper or aluminum conductor. The parallel groove clamp makes connections easier... two conductors from #8 solid to #4 can be inserted without removing the terminal nut.

For more details on this power engineer's capacitor, write today for Bulletin 1120.



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

PC35-4

"We eliminated Motor Burnouts and cut new installation costs – by using Fusetron dual-element Fuses!"

"Our organization services some 43 Alfalfa Mills in the central Nebraska area.

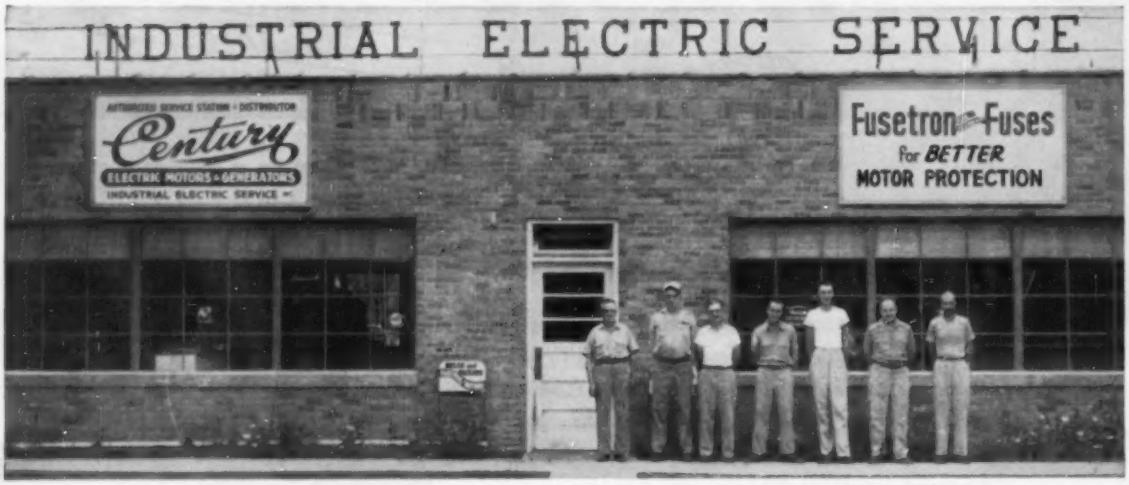
"We know, from experience, that overloads and single phasing are two of the most common causes for motor failures in these mills.

"In order to give these motors the protection they need, we use Fusetron fuses in motor-running protection sizes. As a result, we have eliminated motor burnouts for our customers.

"In addition, on new installations, we have found that smaller switches can be used with proper size Fusetron fuses.

"We can pass this substantial saving along to our customers and still give them safer protection than can be had with ordinary protective devices."

Max T. Moore, Vice-President
Industrial Electric Service, Inc.
Kearney, Nebraska



Here's why Fusetron dual-element fuses give DOUBLE protection to large motors

Of course, large motors are protected with thermal cutouts or overload relays. But experience has shown that such devices sometimes stick or fail to operate. When they do, the motor burns out.

On normal installations, by replacing fuses used for short-circuit protection with Fusetron fuses of motor-running protection size, you get the same short-circuit protection PLUS double protection against motor burnout from overload or single phasing.

If thermals or relays fail to operate for any reason, the Fusetron fuses will act independently to SAVE THE MOTOR.

And Fusetron fuses protect against waste of space and money — permit use of proper size panels and switches.

On motor circuits Fusetron fuses can be used in sizes near to the operating load. That cannot be done with ordinary fuses. It is possible with Fusetron fuses because they have a tremendous time-lag that prevents them from opening on starting currents or other harmless overloads.

This means that on new installations for motor circuits you can save space and money because *proper* size Fusetron fuses permit using *proper* size switches and panels instead of *oversize*.

You too, can profit by the 10 point protection of Fusetron fuses

1. High interrupting capacity — protect against heaviest short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
2. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
3. Protect against needless blows caused by harmless overloads.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. **Protect against waste of space and money — permit use of proper size switches and panels.**
6. **Protect motors against burnout from overloads.**
7. **Give DOUBLE burnout protection to large motors — without extra cost.**
8. **Protect motors against burnout due to single phasing.**
9. Make protection of small motors simple and inexpensive.
10. Protect coils, transformers and solenoids against burnout.

For more information on Fusetron fuses write for bulletin FIS.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS . . . USE BUSS HI-CAP FUSES

They have unlimited interrupting capacity to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.

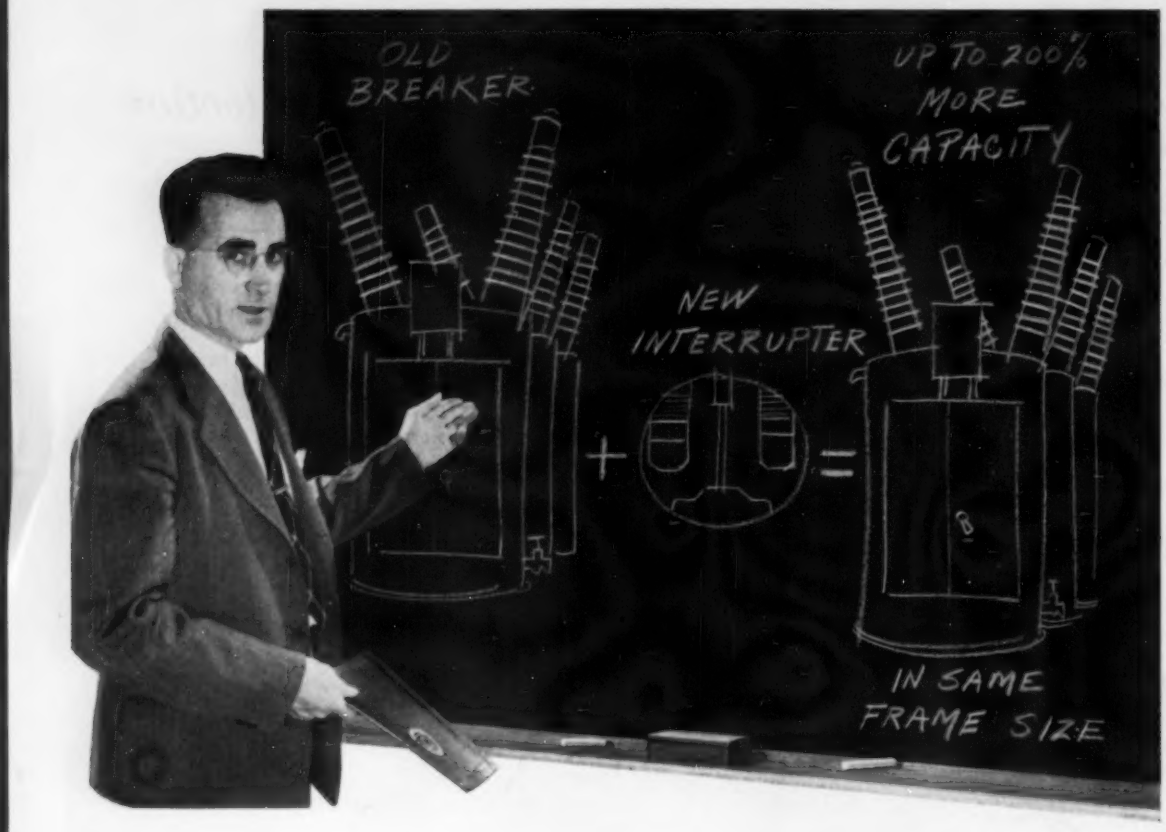
Write for bulletin HCS.

On new construction, tell your architect to specify this Safer, Better Protection.

BUSSMANN MFG. CO. (*Division of McGraw Electric Co.*) UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

1055



Meet load growth, lick costs with unique breaker Modernization Plan

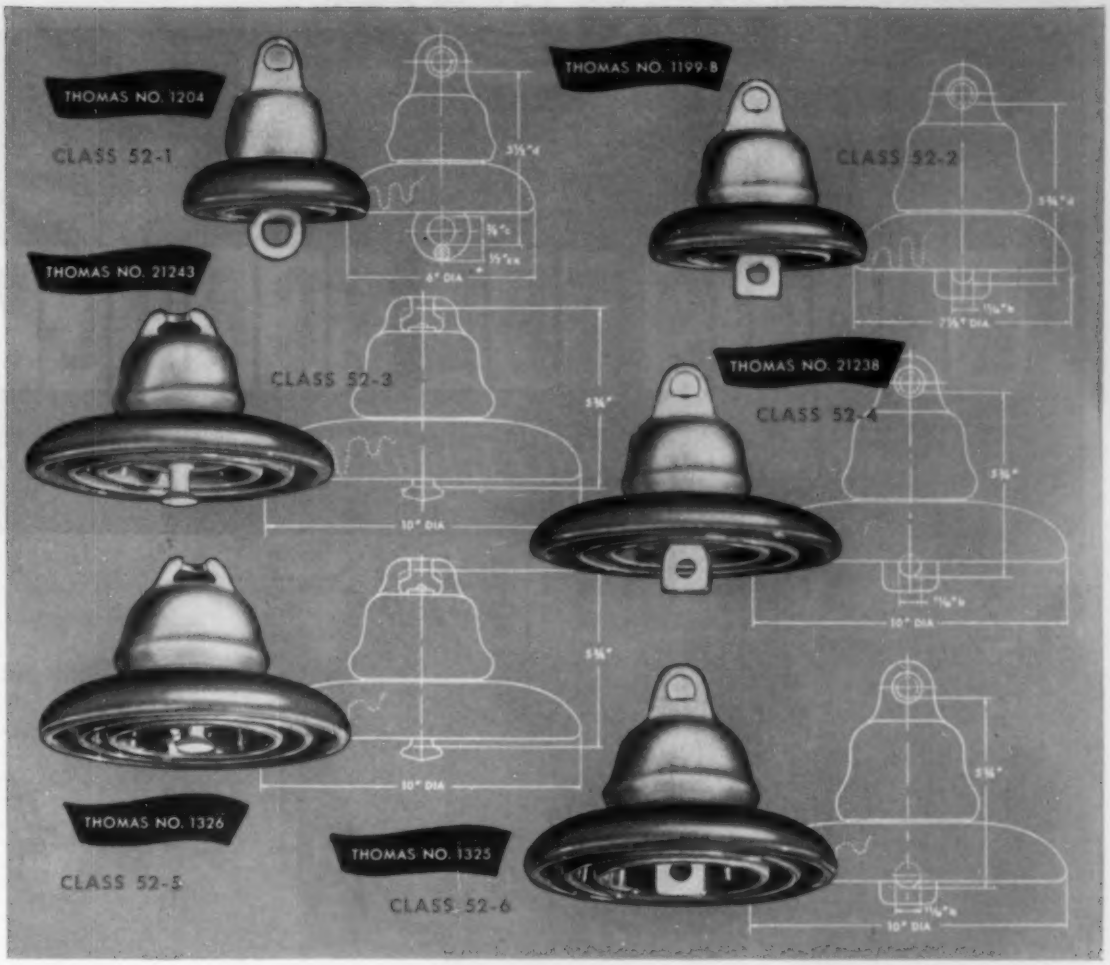
The shortest distance between old breakers and new breakers is the Westinghouse Modernization Plan. The plan is simple and costs approximately one-third the price of completely new equipment, installed.

This is how it works. You tell us the style and rating of your present breakers. We will provide you with a new interrupter and contact assembly for the Westinghouse O, G, GO or GM frame-mounted or floor-mounted breakers. Install the interrupters yourself; neither tanks nor foundations need be disturbed. The result? Rejuvenated breakers . . . additional capacity of anywhere from 50% to 200%, and added breaker life of up to 15 years.

Interrupters furnished are, of course, the exclusive Westinghouse magnetic De-ion® or multi-flow De-ion grid types which offer you standards of performance your present equipment can no longer provide.

Have your Westinghouse sales engineer give you final details of this quick and inexpensive breaker Modernization Plan, or write to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-60882

YOU CAN BE SURE...IF IT'S Westinghouse



THOMAS EEI-NEMA STANDARDS

Two of the strongest arguments for standardization are stock simplification and the advantages of interchangeability. Although we catalog many different designs, we are 100% in support of any standardization that we believe helps the industry. Therefore, we suggest users specify EEI-NEMA Standards for their suspension insulator requirements.

Thomas insulators are backed by 82 years of ceramic experience and knowledge. Quality material, precision manufacturing and PROOF OF PERFORMANCE make Thomas porcelain the standard of comparison for discriminating engineers throughout the Electrical Industry.

In 1907, Thomas designed and made the first cap-and-pin suspension insulator. Units installed that year are still giving trouble-proof service after 48 years of continuous operation.

Specify Thomas EEI-NEMA Suspension Insulators with full confidence that their quality and value cannot be surpassed.

The R. Thomas and Sons Co.

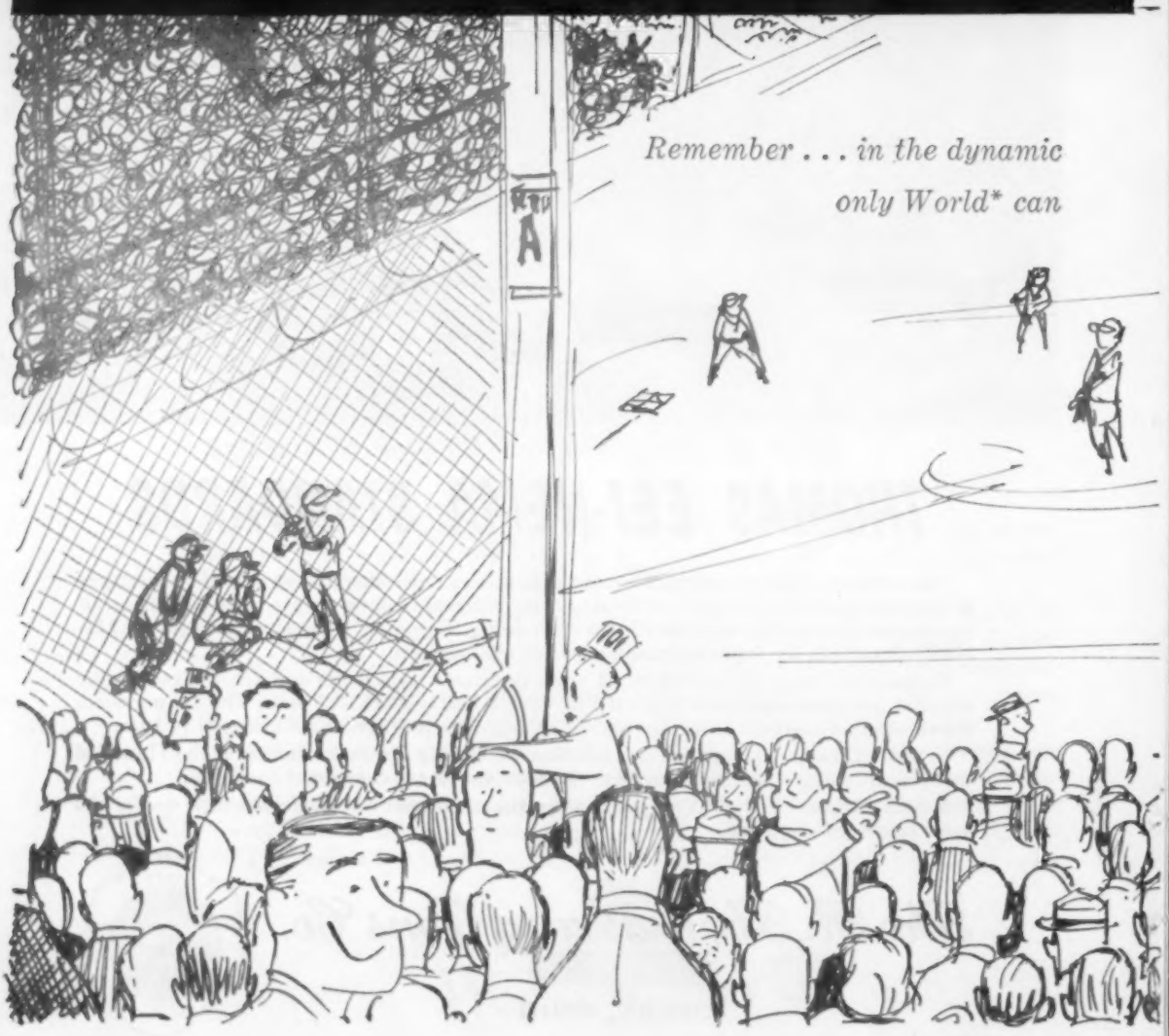
LISBON, OHIO

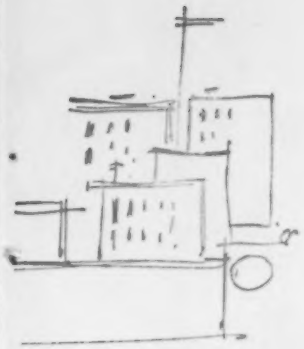
1873 THOMAS INSULATORS RELIABILITY our 82nd year 1955

How many rural and residential customers this year?
What's the outlook for appliances? How much are utilities spending?
And what about future expansion? Capacities? Revenues? Which way costs?
How about maintenance, wages, rates, taxes . . .

WHAT'S THE SCORE?

—*check with Electrical World's Editors*

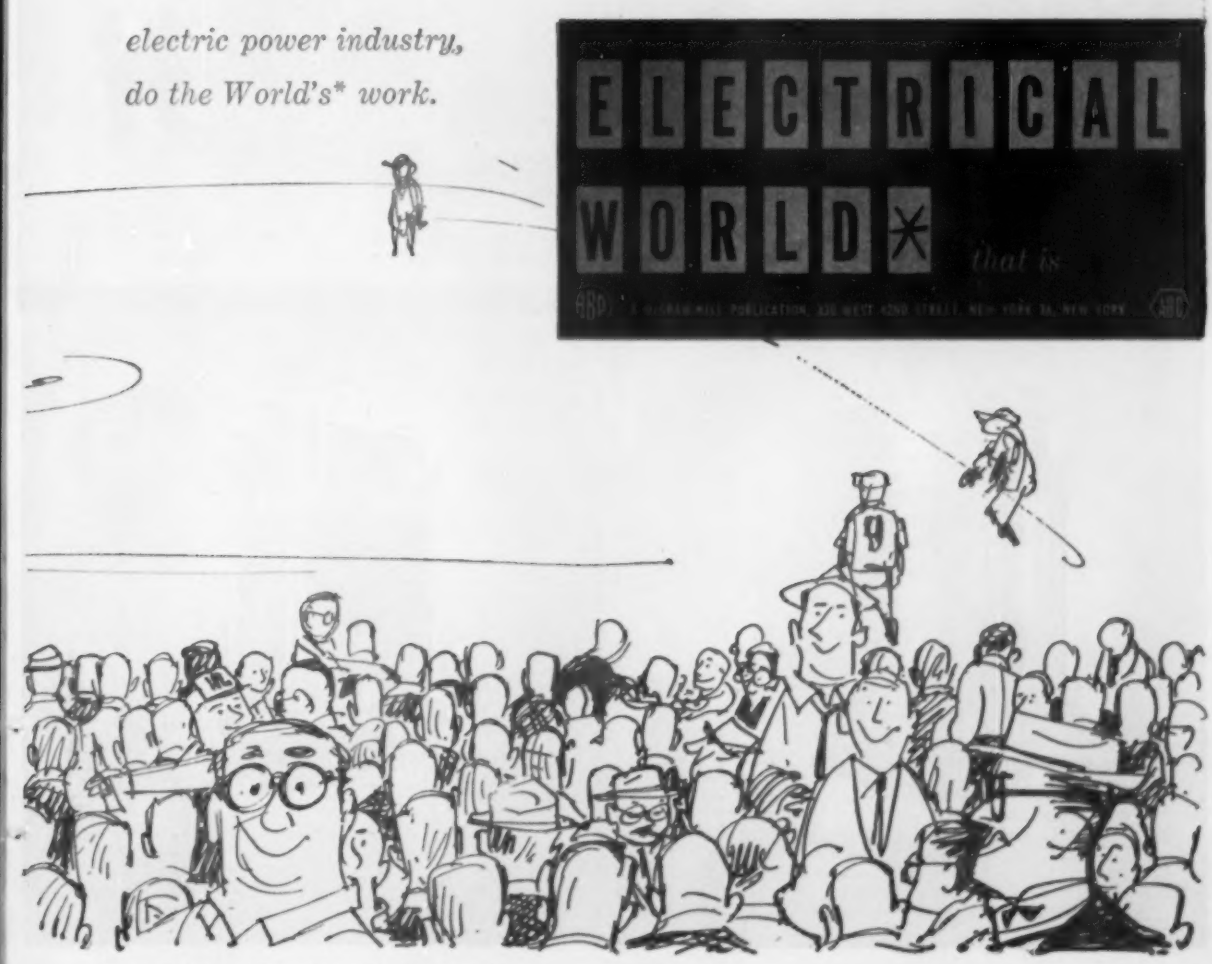




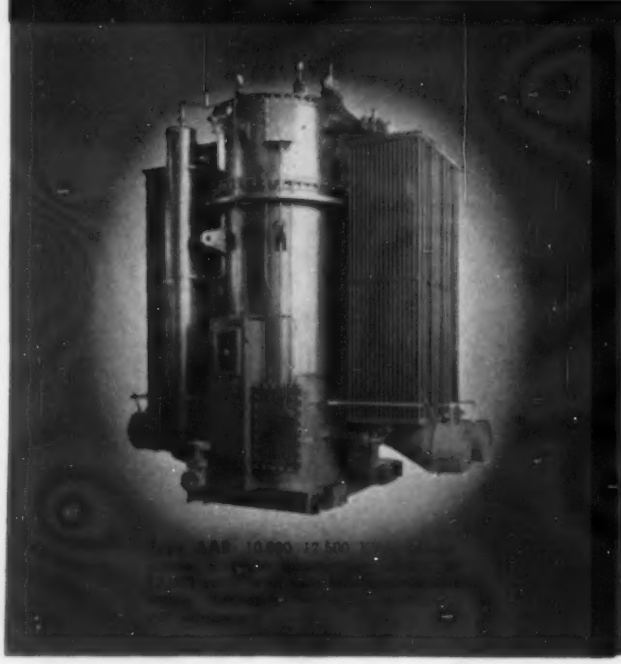
To know the score, reserve a seat in the scorekeeper's box. Averages, earned runs, rbi – Electrical World keeps tabs on the whole electric power industry inning by inning, in the *Annual Statistical Issues* – and no manager would switch strategy or make a move without them. Same thing with the *Steam Station Costs Studies* . . . since 1928 they've been putting the squeeze on the cost of a kilowatt-hour, and now they've got their eye on a rookie – nuclear energy – mainstay of the team someday. Pennant chances next year? The *Forecast Issues* scout out the "comers," point up trends, provide a planning guide for the future.

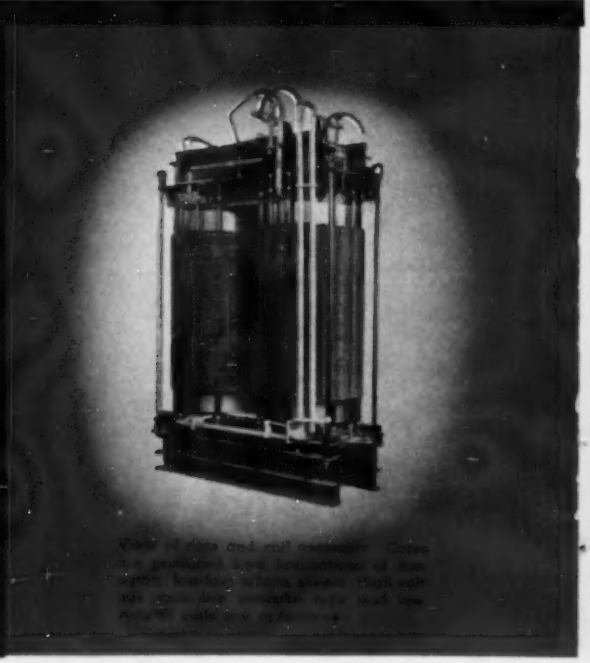
These big ones are important, sure. But you don't go from the cellar into the Series. It's in World's authentic, week-in week-out score-keeping on power output, capital spending, technology, and capacity changes that conscientious, on-the-road reporting pays off. This is the real reason behind the 4-to-1 preference for Electrical World *among your own best customers and prospects.*

electric power industry,
do the World's work.*



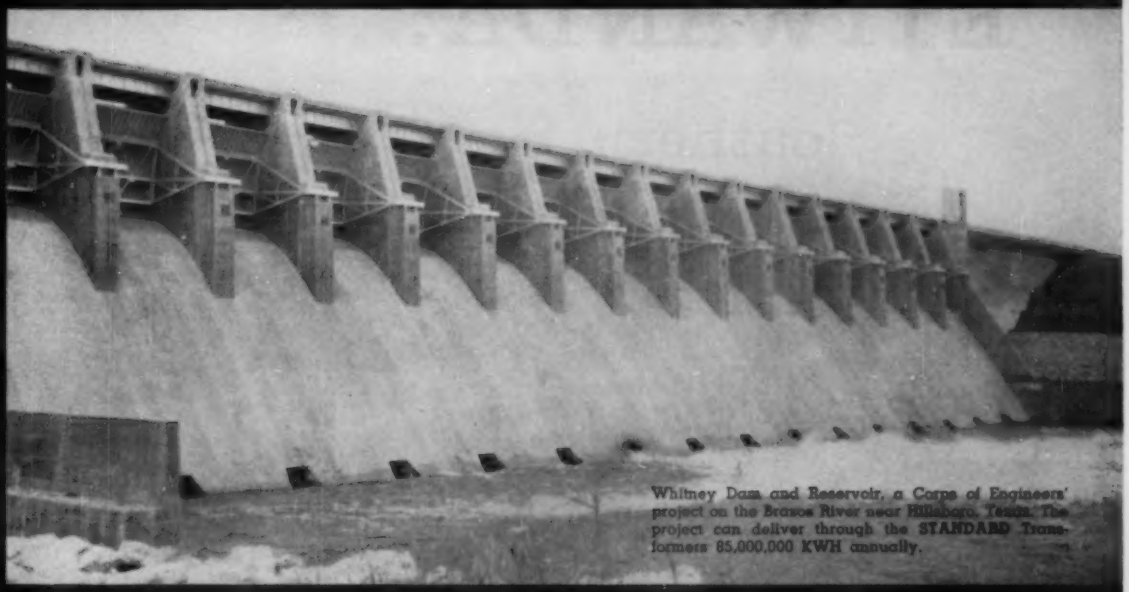
Three 10,000/12,500 KVA transformers built by the Standard Transformer Company for the Whitney Dam and Reservoir project in Texas.





Standard builds them BIG for Whitney Dam

TRADE MARK ®



Whitney Dam and Reservoir, a Corps of Engineers' project on the Brazos River near Hillsboro, Texas. The project can deliver through the STANDARD Transformers 85,000,000 KWH annually.

● There was a time when **STANDARD** built transformers that were no bigger than a pound of butter. Now our engineers take installations like the Whitney Dam and Reservoir project in stride. In the factory, **STANDARD** craftsmen have become accustomed to building large transformers quickly and accurately.

Here are a few statistics. Each 10,000/12,500 KVA transformer at Whitney Dam weighs 40 tons. The transformers are capable of stepping up 13,200 volts to 69,000 volts. They can convert enough power to supply a fair-sized city. There are 2,900 gallons of oil in each, and the elements weigh 40,000 pounds apiece. It takes 6,300 pounds of copper alone for each transformer. They are 18 feet high and are air cooled with fans for 12,500 KVA supplemental rating.

When you have a need for transformers, whether large or small, don't hesitate to call your **STANDARD** representative.

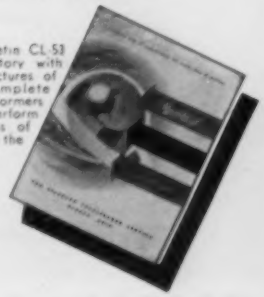
Standard

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

Write for Bulletin CL-53 It tells the story with words and pictures of Standard's complete line of transformers and how they perform for every class of service . . . on the job.



for

ETIWANDA...

Southern California Edison *specified*

B U R

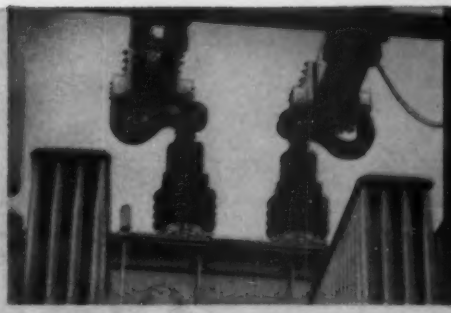
One of the largest ALL-ALUMINUM bus installations in utility history—SoCalEd's new Etiwanda station—uses Burndy connectors *throughout*. Station engineers' confidence in Burndy was logical:

- *Burndy's 11-year aluminum research program, in close cooperation with public utility companies, pioneered major developments in aluminum connectors and procedures.*
- *Burndy's vast experience with substation connector engineering—unmatched in the industry—prepared Burndy engineers for Etiwanda's new and complex requirements.*

Count on Burndy to serve the needs of your most creative engineering.

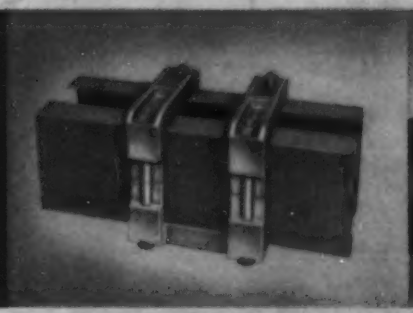
For latest developments in aluminum bus connections see Burndy Catalog AL55. Write or ask our representative to call.

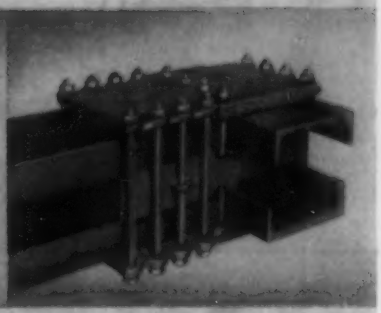
BURNDY — NORWALK, CONNECT. — TORONTO, CANADA



Burndy flexible braid connectors carry the full load current of the transformers from the terminals to the bus system. The flexible design isolates and eliminates the transmittal of vibration that might crack insulators or cause damage to the structure or equipment.

Aluminum channel square bus makes liberal use of Burndy aluminum bus supports, type UH-B-A, which can be seen in the photo. Some slide-fit types are also included where movement of the bus under thermal expansion is to be permitted. Horizontal bus runs are tapped through rugged Burndy NT-B-A Aluminum T-connectors.





N D Y

Of critical importance — numerous cable-to-flat bar connections. Burndy specially-designed aluminum NA-G-A terminals; shown before and after installation.

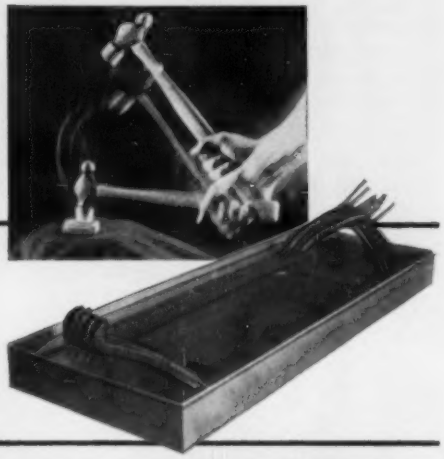
Factories: NEW YORK, CALIFORNIA, TORONTO · *Export:* PHILIPS EXPORT COMPANY

NEW Silco-Flex MOTOR INSULATION

Offers These Amazing Physical Properties

Allis-Chalmers, working with Dow Corning Corporation, has developed *Silco-Flex* motor and generator insulation . . . truly new in concept . . . truly new in effectiveness.

Silco-Flex insulation employs a pure silicone rubber combined with specially developed application techniques to produce an insulation unmatched by any other in use today.



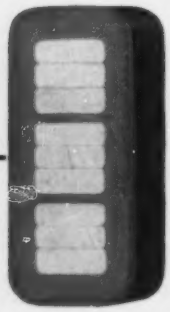
● **Flexibility and Resilience** — *Silco-Flex* insulation remains flexible and resilient indefinitely. It is especially resistant to mechanical abuse and to stresses of overloading, rapid starting and stopping.

● **Moisture Resistance** — Completely sealed, *Silco-Flex* insulated coils are the most moisture-resistant commercial coils ever produced. They are production-tested while submerged in water . . . by far the most complete and searching high potential test used.

● **Abrasion Resistance** — Samples of insulation at right show effects after sandblasting with 90 grit aluminum oxide and 100 psi air for one minute. Nozzle-to-sample distance was six inches, thickness equivalent to 2300-volt insulation. Note difference in abrasion!

Silco-Flex Insulation | Polyester Mica Tape | Asphaltum Mica Tape

● **Homogeneity** — *Silco-Flex* insulation is a void-free dielectric barrier vulcanized into a unified insulating wall. It maintains its homogeneity under extremes of differential expansion and contraction due to thermal cycling.



Other Advantages include exceptionally good thermal stability and chemical inertness. *Silco-Flex* insulation is also a much better heat conductor than ordinary electrical insulating materials. Moreover, enclosures now required to protect windings from moisture and abrasion may be eliminated in many cases.

New *Silco-Flex* insulation is immediately available for all Class H form-wound coils and for Class A and B windings operating under selected service conditions. For complete information, call your Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4774

Silco-Flex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Another Utility Case History

Since 1939: thousands of poles preserved with low-cost PENTA

Since WISCONSIN POWER AND LIGHT COMPANY installed its first Penta-treated pole 16 years ago, the company has placed nearly 15,000 more Penta-treated western red cedar and southern yellow pine poles, and countless western fir crossarms, in southern Wisconsin. Today, even the oldest of these units are as good as new, have *many more years* of service ahead of them—an impressive example of lasting Penta wood protection!

ELIMINATE REPLACEMENT OF CROSSARMS WITH PENTA

Not only does it cost $5 or more to replace a single crossarm, but consider the trouble and expense of freighting timber, working "hot" lines, switching attachments to thousands of new crossarms a year! Penta eliminates crossarm replacement by protecting wood against rot and insect attack. Crossarms treated with Penta last the 30-year lifetime of a pole! And the cost of preserving wood with Penta is surprisingly low, in fact the cheapest insurance you can buy!

SPECIFY PENTA PROTECTION for Poles . . . Crossarms . . . Transformer Platforms . . . Braces . . . Control Boxes . . . Planking. Mail coupon below for list of more than 85 treating plants that will apply Penta for you, and for FREE Penta booklet, "Poles and Crossarms."

PENTA-TREATED WOOD DOESN'T BURN HANDS

Penta stays locked in wood, can't bleed or leach out! That's why Penta-treated wood is clean, can't "burn" hands or stain clothing.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY, WHICH SERVES MANKIND

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Box 478-M-8, St. Louis 1, Missouri

Please send: ☐ List of Penta-treating plants
☐ FREE "Poles & Crossarms" booklet

Name.....

Address.....

City..... *State*.....

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depend on
the only

long range economy fuel

You'll win in the long run by burning Bituminous! Today and tomorrow, supply is unlimited and the vast reserves are right on the threshold of the major manufacturing centers. Bituminous, too, has the highest potential for cost improvement among competing industrial fuels. Year in and year out new methods and machines are designed to control costs and improve burning efficiency.

Let B&O's Technical Service fit this fuel to your long range power plans.
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Phone: LExington 9-0400

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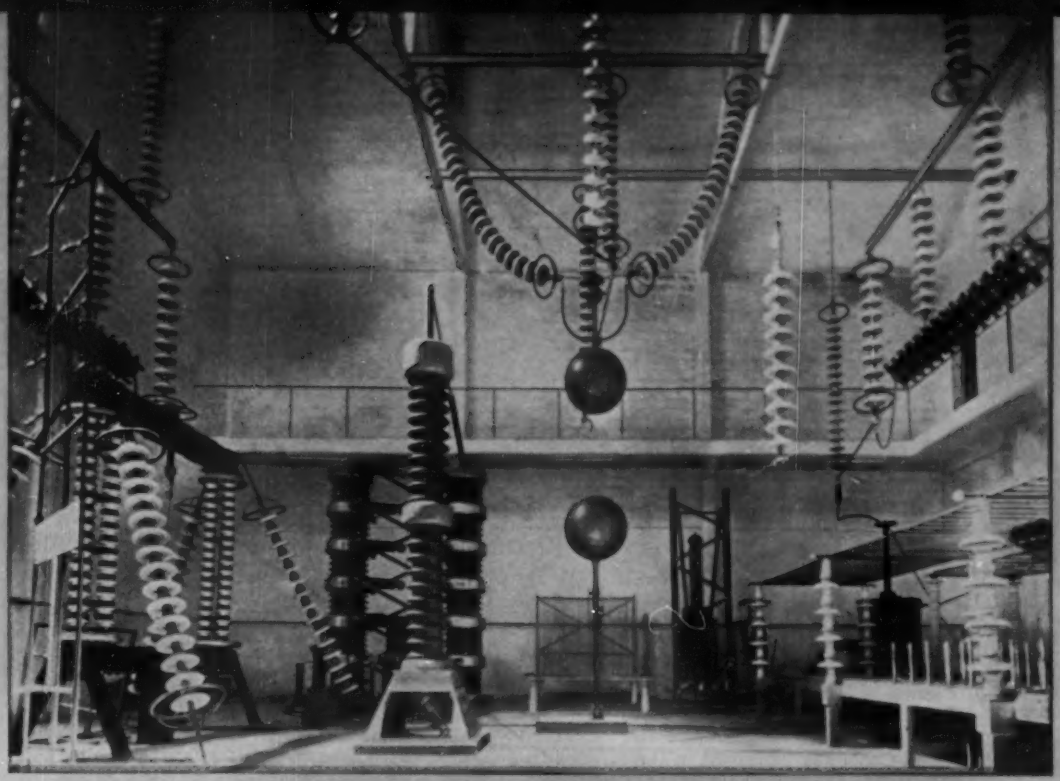
BITUMINOUS COALS FOR EVERY PURPOSE

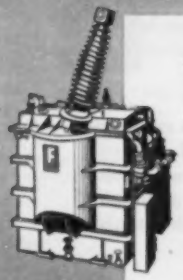
FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



ARGENTINA

A 1,000,000 volt Ferranti Impulse Generator installed in the Laboratories of Fabrica de Porcelana Armanino, Buenos Aires, Argentina.
This equipment produced the first ever 1,000,000 volt arc in Argentina. Ferranti have also supplied to the same customer a 500,000 volt, 250 kVA, A.C. Testing Equipment.



TRANSFORMER CAPACITY OF OVER 5,000,000 kVA per annum

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

F
FERRANTI

FERRANTI LTD

Head Office and Plant : HOLLINWOOD, LANCASHIRE, ENGLAND

P.T.168/2

OFFICES AND PLANTS

NEW YORK : Ferranti Electric Inc. 30 Rockefeller Plaza, New York 20, N.Y.
TORONTO : Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario.
MANCHESTER, ENGLAND : Ferranti Ltd., Moston, Manchester, 10.
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THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

General Cable has pioneered in the research and quality-controlled manufacture of Service Drop Cables. Down through the years their extremely high uniformity and dependability have gained an outstanding reputation.

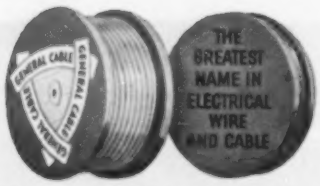
Examples of the more popular types are:

Service Drop Aerial Messenger Types are available in constructions consisting of one, two or three insulated conductors twisted around a bare messenger. *Conductors* in aluminum or copper. *Insulations* are available in neoprene, polyethylene, or rubber and neoprene. *Messengers* are available in aluminum, ACSR, copper, copperweld, or copper-copperweld.

Service Drop Type SD is available in either aluminum or copper conductors . . . with one insulated conductor, or two parallel insulated conductors with concentric uninsulated neutral conductor . . . flame-and-moisture-resistant covering.

See your friendly General Cable Representative for complete listings and more details.

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.

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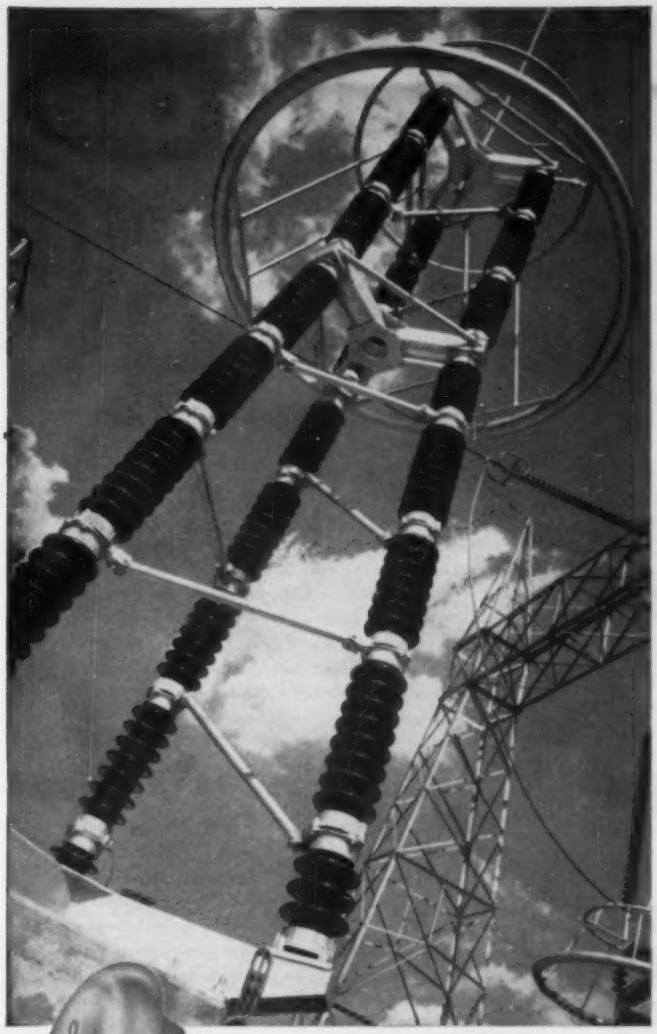

World's largest self-supporting lightning arrester. Designed by Westinghouse Electric Corporation. Being used to gain more data about corona and the transmission of high voltage electricity.

⅝"—11 x 3
Oval Neck
Silicon Bronze
Connector Bolt

ARRESTED!

Costly Corrosion
Costly Breakdowns
Costly Complaints

ARRESTED BY HARPER FASTENINGS!

Whatever your equipment—whatever the corrosive agent—you get added insurance... you're assured trouble-free performance from Harper Everlasting Fastenings.

They're made exclusively from the corrosion-resistant metals. They're available without delay in a wide range of types, sizes and alloys. More than 7,000 different items are carried in stock.

Protect your equipment, prolong its life. Harper Fastenings can meet *all* your requirements. Call the Harper Branch Office or Distributor near you, or write for helpful information.

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BOLTS • NUTS • SCREWS • WASHERS
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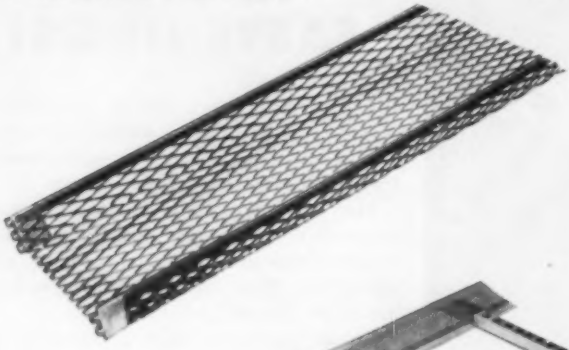
STANDARD CABLE SUPPORTS

This Cope quickly-erected, standardized system is ideal for supporting runs of power, signal and control cables in industrial plants and power generating stations. All units in the Cope system are equipped with the new Pin-type coupler which permits sections to be joined together in a matter of seconds to form a strong mechanical joint without the use of nuts, bolts or washers.

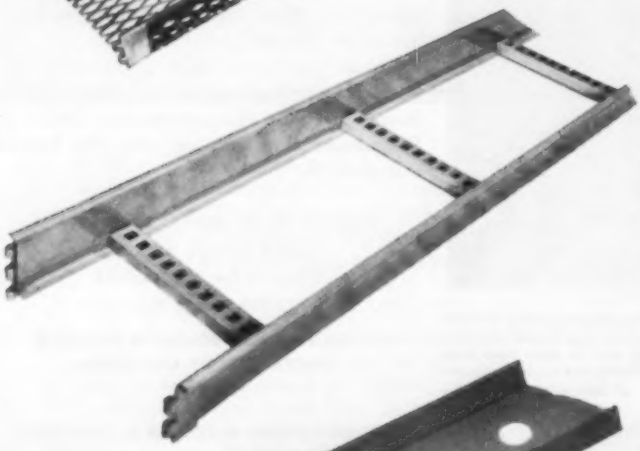
Cope also supplies a complete line of mounting brackets for Trough, Channel and Ladder which can be hung from almost any structural member.

For complete information, write for Bulletin 67 and 67A.



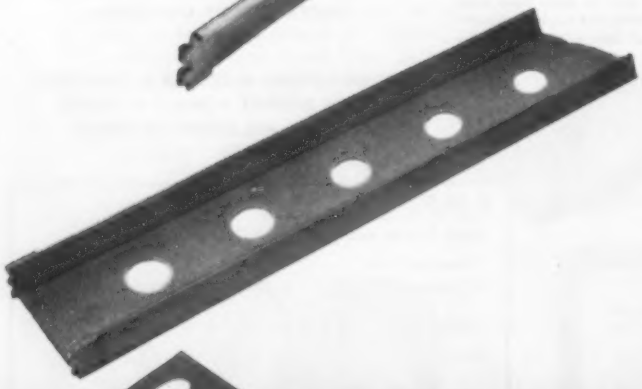
CABLE TROUGH

The popular expanded metal Cable Trough is ideal for supporting runs of non-metallic jacketed cables where continuous support is required. The trough is supplied in widths of 6", 9", 12", 18" and 24" and lengths of 8, 10 and 12 feet. Standard fittings for each width permit the trough to make changes in direction and elevation, join and cross, and, in short, conform to any plant layout.



CABLE LADDER

This new Cope product has been developed specifically for the support of armor and other semi-rigid cables which require only intermittent support. Basically, the Cope Galvanized Steel Ladder consists of two main "Z" shaped stringers to which rungs are welded on 18" centers. The rungs are suitably slotted to permit cables to be quickly clamped to them with simple band type cable straps and pads. Cope Cable Ladder is supplied in widths of 6", 9", 12", 16", 18", 20" and 24" and in 12 foot lengths. Ladder sections have been designed to connect with Cable Trough of similar width. Horizontal and vertical fittings for all widths are standard items.



CABLE CHANNEL

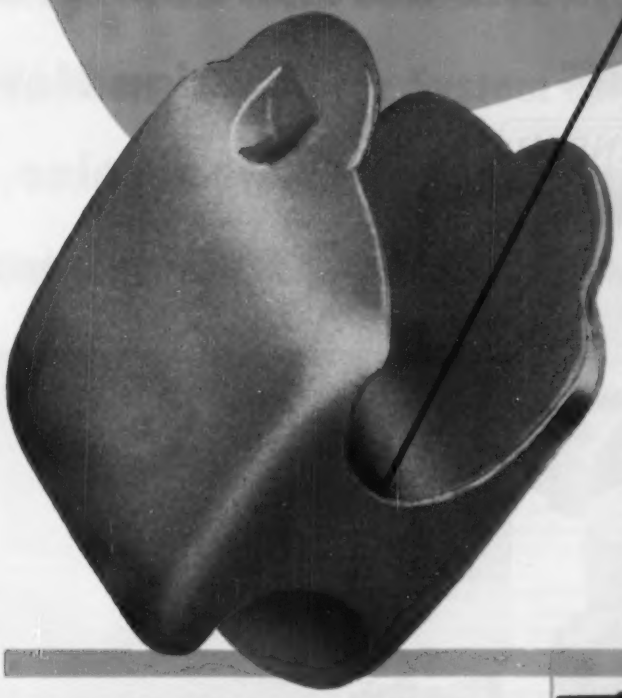
The Cope Cable channel has been designed to supplement ladder and trough by providing an economical means of supporting a limited number of armored or non-metallic jacketed cables—such as would occur in branch runs, etc.

Cope channel is available in 12 foot lengths in widths of 3" and 4". All sections except vertical risers are provided with ventilation and drainage holes. Horizontal and vertical fittings are also available.

T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.

The Secret is in the "built-in" Spacer

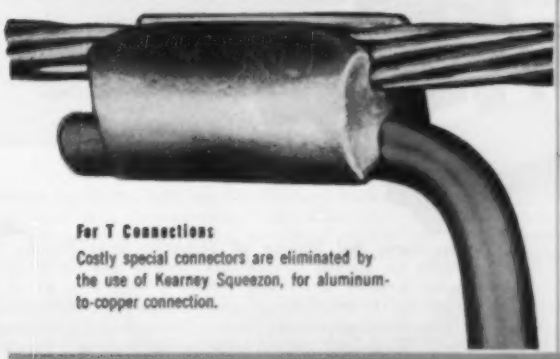


KEARNEY SQUEEZON

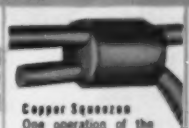
CONNECTORS are designed for greater versatility

The exclusive Kearney design provides the "built-in" spacer. This barrier of metal between the conductors resists galvanic action and, in addition, assures greater conductivity since each conductor is "cold-welded" around its perimeter. Because the wires do not touch each other, there is less danger of flattening or pinching the strands.

KEARNEY SQUEEZON connectors are applied with hydraulic or mechanical tools, in less time . . . at a fraction of the cost of older types of connectors.



For T Connections
Costly special connectors are eliminated by the use of Kearney Squeezon, for aluminum-to-copper connection.



Copper Squeezon
One operation of the Squeezon compression tool permanently bonds this type of joint.

Service Entrance Sleeves
for high-pressure connections of secondary to meter loop.

Dead-Ends
One crimp per Squeezon saves time when multiple connections are used.

Stirrup Tap
Two Squeezons and a short piece of wire make an inexpensive, easy-to-install stirrup, insures a rigid, connection on hot lines.

Aluminum Squeezon
Provides large area contact — prevents cold flow; for aluminum to copper or copper to aluminum.

Line Splice
Line splices are better electrically and mechanically with Kearney sleeves.

For Better Construction . . . Safer Maintenance

JAMES R. KEARNEY

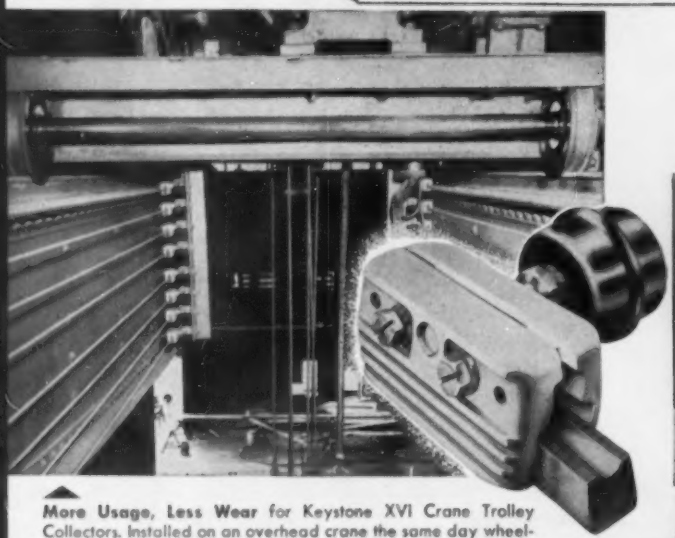
Specify **KEARNEY PRODUCTS** *The Mark of Quality*

JAMES R. KEARNEY CORPORATION • 4324-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

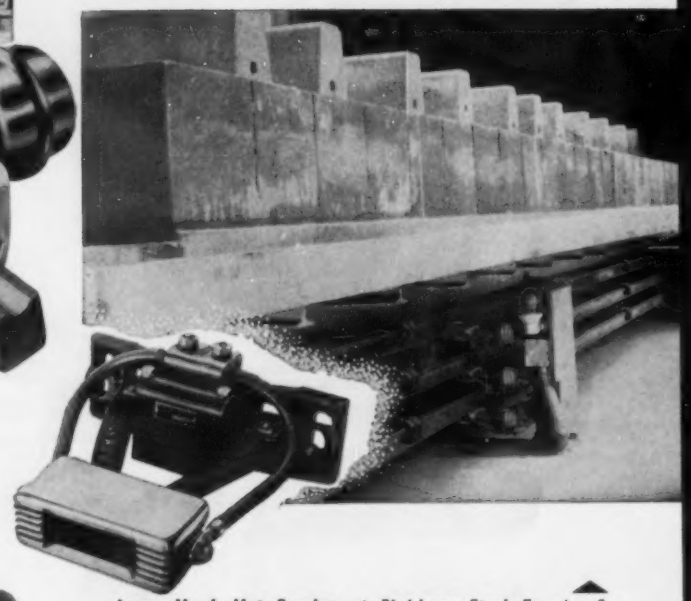
Drop all your

The ELECTRIC SERVICE

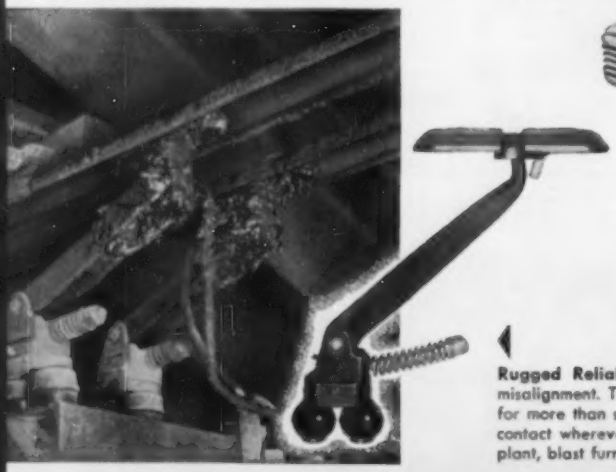
1. Design New
2. Modernize
3. Recommend



More Usage, Less Wear for Keystone XVI Crane Trolley Collectors. Installed on an overhead crane the same day wheel-type collectors went on a similar crane, they were in operation 50% longer each day. When wheels were removed due to failure, the XVI renewable carbon shoe contact inserts still had many months of life ahead.



Long, Hard, Hot Service at Birdsboro Steel Foundry & Machine Co. Loaded furnace cars move in and out of heat treating furnaces safely and without a hitch. Rails on each furnace car contact stationary columns equipped with Keystone LMI Pony-size Contact Rail Collectors. These reversible collectors offer 30% greater contact travel, efficient current transfer.



Rugged Reliability in the face of dirt, rainy and icy conditions, and severe misalignment. These Keystone Inverted-V Universal Collectors have operated for more than seven years at the Alan Wood Steel plant. They give positive contact wherever the going is rough, tough, and dirty—in open hearth, coke plant, blast furnace.

ELECTRIC SERVICE MANUFACTURING CO.,

third-rail

problems on his desk!

Engineer will collaborate and . . .

Keystone Conductor System (Steel, Aluminum or Copper)

your Present System for Greater Efficiency and Economy

Suitable ESM Equipment for the Job

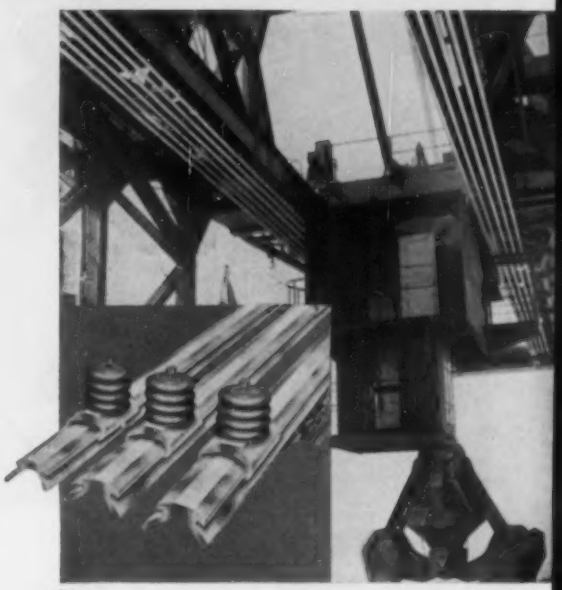
INDUSTRIES rely heavily on the Electric Service engineer for designing or converting power Conductor Systems. There are three main reasons:

ESM ALUMINUM, STEEL, COPPER SYSTEMS—All three are designed and built by Electric Service. Each has its proper applications, resultant economies. The system specific to *your* needs is recommended without bias.

ESM SERVICE IS COMPLETE—Engineering counsel is backed up by the complete line of Keystone Equipment and by ESM installation specialists. Electric Service engineers new systems, modernizes inadequate systems, repairs existing systems.

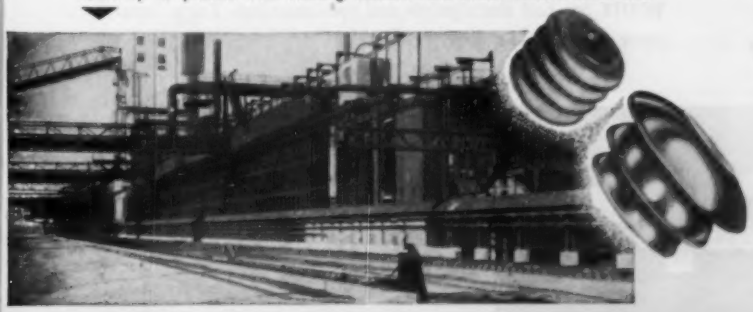
ESM PRODUCTS ARE JOB-PROVED—They're at work on all types of materials handling equipment in every industry—steel mills, power plants, docks, rail yards, processing plants. Typical installations shown here illustrate the scope and reputation of Electric Service in this electrical power-transmission field.

What's your problem?—insufficient power? . . . severe weather or corrosion conditions? . . . production-sapping shutdowns? . . . excessive maintenance? Write today for assistance.



Aluminum Reduces Corrosion, cuts deadweight for Canton Co. Baltimore Harbor's salty dampness doesn't faze Keystone Integrated Aluminum Conductor System. High-speed ore unloader utilizes aluminum on trolley conductors and on 1200-ft., 2300-volt main runway. Aluminum Under-running System has high current capacity, low voltage drop, sensitive control.

Unhurt by Volts, Jolts are the Keystone Insulators on Fairless Works coke oven rails. Petticoat-type Porcelain Insulators resist contamination by dirt, moisture. Shock-proof, non-absorbent moulded type Insulators team up to protect over-running contact rails under severe conditions.



KEYSTONE
INDUSTRIAL
POWER
PRODUCTS

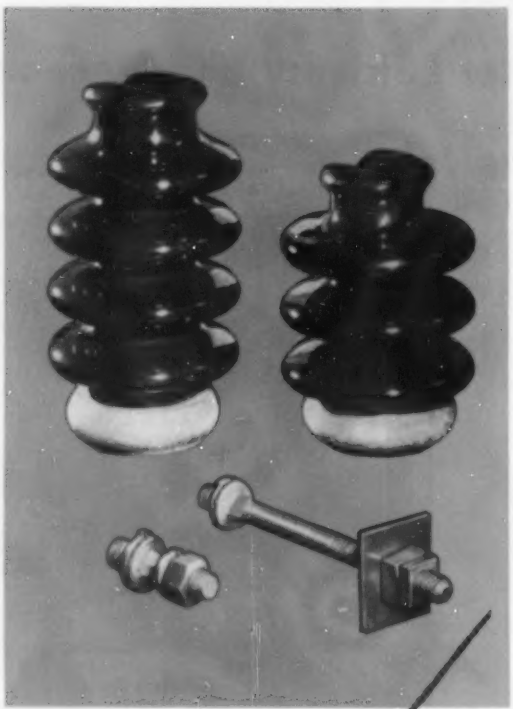
Philadelphia 32, Pa.

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

NOW!

LAPP LINE POST PERFORMANCE

for your distribution lines



The Lapp Distribution Post is available in units of two sizes, the over all heights being 7" and 9". Separable studs . . . of any desired length. In addition, a special low-priced galvanized steel pole top bracket is offered specifically for use with these insulators. With either unit, it develops the full 1500 lb. cantilever strength at the top of the insulator.

New Lapp Distribution Post insulators are "baby" Lapp Line Posts—and priced in the range of distribution insulators. At duty up to 25 Kv, they offer the trouble-free kind of operating service that has been characteristic of Lapp Line Posts.

SOLID ONE-PIECE PORCELAIN. The body is a solid porcelain, machine-finished all over including conductor and tie wire grooves. Base is externally attached and studs are interchangeable—any required length being available.

FOG-TYPE. Multiple short petticoats, characteristic Lapp Fog-Type design, provide an exposed uniform leakage path and self-cleaning feature—most efficient for duty in contaminated atmosphere.

LIGHTNING- AND MECHANICAL-ATTACK RESISTANT. Short sturdy petticoats—such as have been proved by nearly 25 years of service on Lapp Line Posts—provide greatest protection from damage by arcover and attack by stones or bullets.

NO CRACKING. The porcelain, held in the large-area low-intensity grip of its cemented-on base, can be loaded only in compression. No internal bursting forces can develop—permanently free from cracking.

PUNCTURE-PROOF. Solid electrical porcelain from conductor to base—no internal conductive pins, or even air space. Completely puncture-proof.

RADIO-FREE. The Lapp Post, by design, is inherently and permanently free from television or radio interference—requires no treatment or coatings.

WRITE for full description and specifications, Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Feature articles on "The Language of Rubber" discuss properties and behavior of rubber in general, neoprene in particular.

Case history shows how a neoprene jacket prevents corrosion, fatigue in steel mooring cables ... Design data is given on new-type pump seal.

New product report on neoprene "jet-action" pipe cleaner ... performance record of neoprene coatings.

Look for "Neoprene Abstracts"—data on new products like this ribbed tire for skate-wheel conveyor, red truck flare, grinding-mill bolt sealer.

You'll find practical ideas on using—and saving with—rubber products

ON EVERY PAGE OF EVERY ISSUE OF

the free

"NEOPRENE NOTEBOOK"

Your free subscription to the "Neoprene Notebook" can prove extremely valuable. A case history may describe a money-saving idea or method that you can adapt to your needs. An on-the-job report may show you how you can cut replacement and maintenance costs with neoprene—Du Pont's chemical rubber. And you'll read articles packed with technical background and engineering information to help you get the most out of rubber products. Start your free subscription by mailing the coupon below today!

SEND THIS COUPON TO GET ON THE MAILING LIST

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, EW-10, Wilmington 98, Del.

Please send me the *free* "Neoprene Notebook" regularly.

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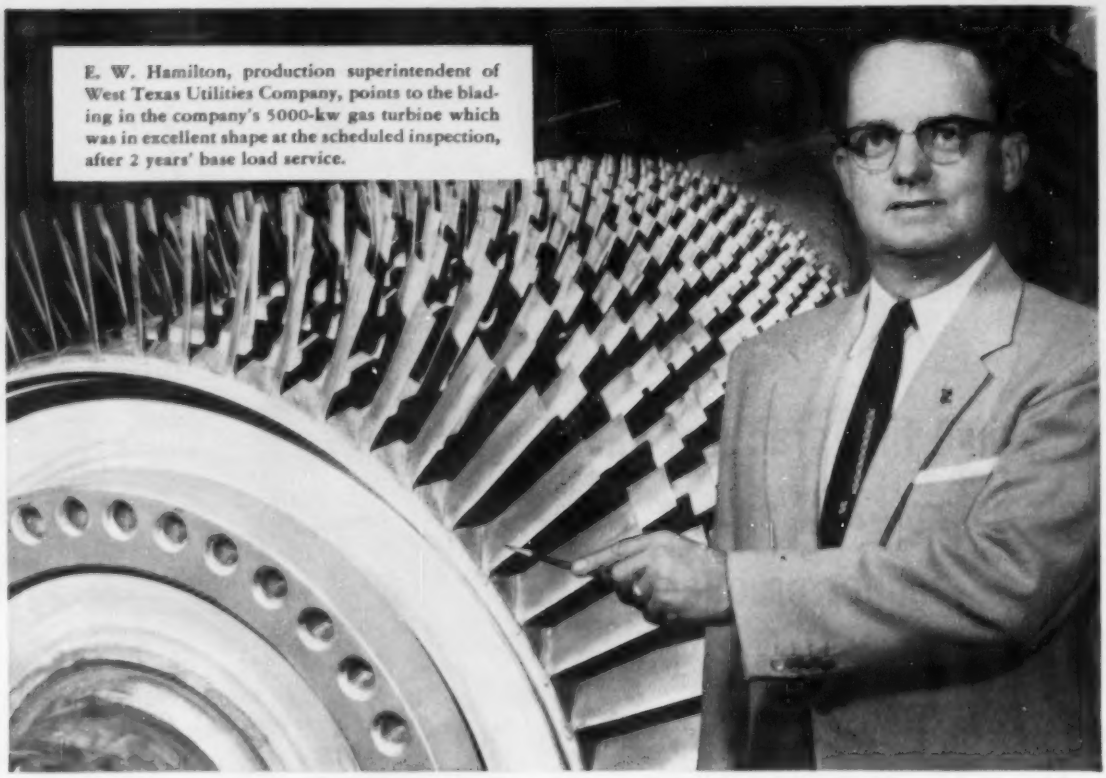


E. W. Hamilton, production superintendent of West Texas Utilities Company, points to the blading in the company's 5000-kw gas turbine which was in excellent shape at the scheduled inspection, after 2 years' base load service.

FACTS on Westinghouse 5000-kw gas turbines . . .

Pays off 5 ways in Texas

At a recent scheduled inspection, the Westinghouse gas turbine at the Fort Stockton station of the West Texas Utilities Company was found to be in excellent condition. After 14,000 hours' operation, one diaphragm was the only part replaced. The used diaphragm is still in good condition.

This is the latest proof that this gas turbine is paying off for West Texas Utilities Company. Here are some others:

- Low installed cost.
- Low water demand—the station is located in an arid region.
- Minimum operating crew—only one operator per shift.
- Inherent dependability—easier to maintain than a steam turbine.

This unit has completely justified its investment and promises to operate profitably for a long time to come. It is performing to all specifications and guarantees and is more than meeting its rated output and efficiency.

• • •

GET ALL THE FACTS about how gas turbines can pay off for you. Call *The Man With The Facts,* your Westinghouse sales engineer, or write for a copy of booklet B-5887, *Westinghouse Gas Turbine Power Plants for Electric Power Generation.* Westinghouse Electric Corp., 3 Gateway Center, Pittsburgh 30, Pa.

J-50576

GAS TURBINE POWER PLANTS FOR ELECTRIC POWER GENERATION . . . 1250 KW TO 15,000 KW

YOU CAN BE SURE . . . IF IT'S

Westinghouse

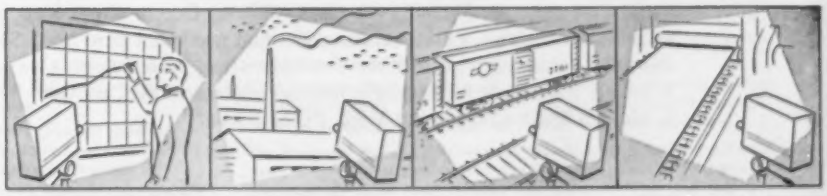
PHILCO *Industrial TV*

The Watchful Eye that *Never Sleeps!*

Now you can have 24-hour supervision of operations . . . perform a thousand and one tasks at a distance . . . in the next room . . . across town or many miles away. In steel, chemicals, railroads, scientific research . . . *in any industry* . . . Philco Industrial TV gives you a fast accurate picture of important operations . . .warns you of dangerous conditions . . . lets you direct progress just as though you were on the scene!

The amazingly compact Philco Industrial TV Camera fits in "out of the way" places . . . can be equipped for remote control of pan, tilt and lens adjustment. The super-sensitive camera easily picks up *all* the detail, even in dimly lighted areas and a powerful, high-definition monitor displays a crisp, clear picture in the room where *you* are. Here's complete control—*right now* saving industry thousands of dollars . . . precious hours . . . even priceless lives! Get complete data on the dependable Philco Industrial TV equipment. Write to Philco Dept. EW today.

Philco Large-Screen Professional TV Monitor and Control Units.



Instantly relays graphic information to vital points. Useful in factories, banks, retail establishments.

Warns of smoke violations. Affords constant protection of property in power plants and factories.

Keeps constant watch on cargo shipments night and day whether by rail, truck or air freight.

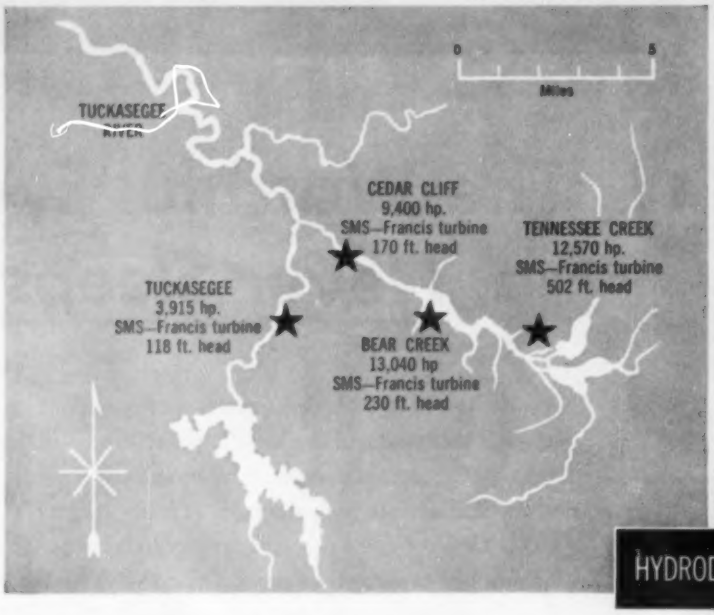
Scans production lines. Warns of mechanical failures. Ideal for steel, paper, auto manufacturers.

PHILCO CORPORATION

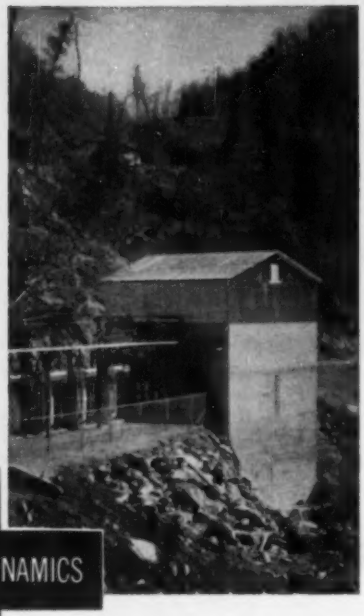
GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44, PENNSYLVANIA

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

HOW ALCOA GOT LOW-COST POWER
DEVELOPING MARGINAL SITES



Between 1949 and 1952, Alcoa developed extra hydropower at low cost from these small sites on the headwaters of the Little Tennessee River.



Cedar Cliff is typical of the small, unattended stations in this development.

To get additional hydropower at minimum costs, Alcoa and its subsidiary, Nantahala Power & Light Company, have reached into the headwaters of the Little Tennessee River. As shown on the sketch map, four small sites on the east and west forks of the Tuckasegee River and Tennessee Creek now permit far greater utilization of the available water. But to make such installations pay, construction, operating and maintenance expenses were carefully planned and closely controlled.

Each of the new facilities is remotely operated from an existing station. Rock fill dams and unlined tunnels helped keep costs down, while powerhouses were built just large enough for the unit. On the SMS turbines themselves, vulnerable parts were given protective coatings of stainless steel to reduce maintenance over the years.

SMS turbines at these four stations have a total rated output of approximately 39,000 hp. All four of these are SMS-Francis types, while at Queens Creek Station a 2,250 hp. SMS-Impulse turbine operates under a 999-foot maximum gross head. SMS butterfly and relief valves supplied with the Tennessee Creek installation.
Whatever your needs for hydraulic turbines and accessories, contact S. Morgan Smith Company at York, Pennsylvania.

HYDRODYNAMICS

HYDRAULIC TURBINES
PUMPS
GATES & HOISTS
TRASH RAKES
ACCESSORIES

HYDRODYNAMICS

ROTOVALVES
BALL VALVES
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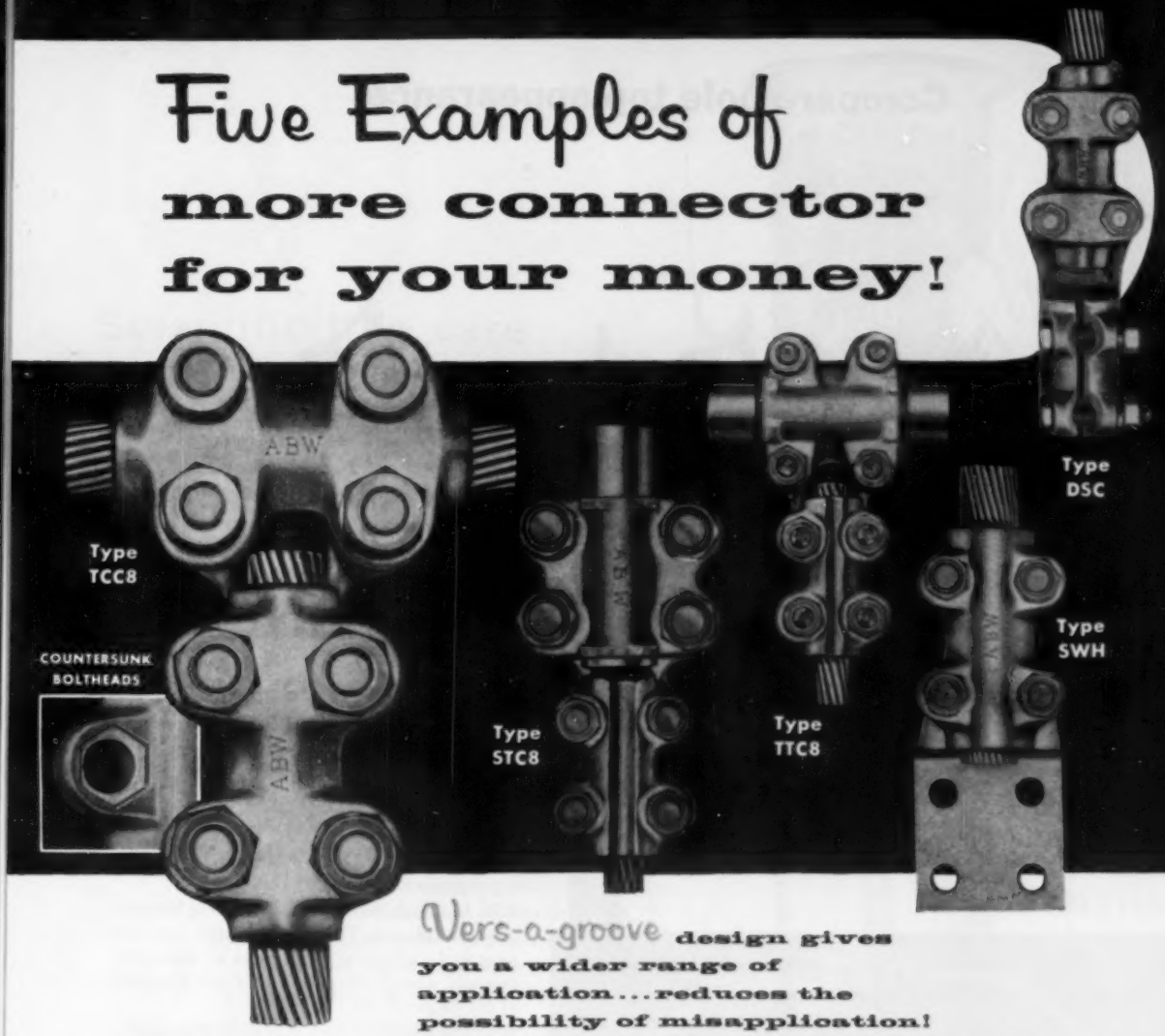
FREE-DISCHARGE VALVES
CONTROLLABLE-PITCH SHIP PROPELLERS

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Five Examples of more connector for your money!



Vers-a-groove design gives you a wider range of application... reduces the possibility of misapplication!

The 9 *stand-out features* of these Anderson Substation Connectors cannot be duplicated by any other connector line available. Look over these features carefully... *several manufacturers may claim some of them, but no connector line has them all!*

1. Two complete pairs of clamping bolts on both main and tap provide *extra insurance* against connector failure. *Most other designs have only six bolts.*
2. Higher clamping pressures with greater contact lengths *than in other standard connectors.*
3. Completely independent (3-piece) clamping on main and tap. Connection can be removed on one side without disturbing contacts on the other. *Most other connectors are two-piece.*
4. Conductor range practically eliminates mis-application and resulting connector "burn-downs". *Limited or no range of other connectors invite mis-application trouble.*
5. Wider conductor ranges permit considerable reduction in overall number of connectors which must be carried in inventory. *Two and three times greater inventory is required with other connectors.*
6. More connector for the money! More metal... 8 bolts instead of the ordinary 6 bolts!
7. One of the greatest advantages of these Anderson Vers-a-groove Tee Connectors is *ease of installation.* The 3-piece design, with independent clamping on main and tap, means that tap conductors may be bolted in on the ground and passed up to install over the bus runs. *Ordinary 6-bolt, 2-piece connectors much more cumbersome and difficult to handle.*
8. Cast surfaces which are inherently rough and tough mean positive electrical contacts. This feature plus the greater clamping strength of these connectors is *a distinct advantage in overall efficiency.*
9. The design of these connectors, by Anderson, has proved itself over more than 27 years of service under all conditions in all parts of the country. *Once used... tried and proved... no customer has ever switched back to an ordinary connector.*

For more complete information, including engineering and design data, performance characteristics and other particulars, consult your nearest Anderson Representative, or write to our home office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION

ANDERSON BRASS WORKS, INC.
P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

Compare pole top appearance!

KPF Switches

modern functional attractive

KPF Air Break Switches look different because they are different. Their pole top appearance is neat and uncluttered. There is a "straight-through" cleanliness of line—the visual appeal of design simplicity.

With this simplicity goes operating dependability and long life. There are no delicate mechanisms to malfunction, freeze, lock from cross-arm warping, need lubrication or wear out. This same simple construction also saves weight. KPF phase units weigh about the same as a comparable insulator stack. Double cross-arms and extra bracing are not needed. Installation is faster and less expensive.

KPF Switches have proved themselves in nearly a half century of major system operation. Why not get the details and make a test installation.

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

For catalog and complete specifications, write direct

KPF ELECTRIC COMPANY
Dept. E 1624 E. Alpine Avenue
Stockton 5, California

Scientific tree care...

The Bartlett Tree Research Laboratories were established by the Bartlett Tree Expert Company in 1926 at Stamford, Connecticut. Here on a 200 acre experimental ground, ideas are tested and developed under actual growing conditions. There are indoor laboratories, too, for the study of insects and diseases which beset shade trees. In fact, it is a complete, down-to-earth laboratory for shade tree ills and ailments.

It is a place for Bartlett scientists to expand the research that already has initiated many innovations in tree care. One: the introduction of a complete, balanced, shade tree food fed through holes in the ground. Another: the successful control of one specific disease by use of chemicals introduced directly into the sap stream of the tree. Still another: developing an emergency sub-irrigation treatment with liquid food and conditioning chemicals introduced under high pressure.

This practical, scientific laboratory, in addition to its continual search for new ideas for the protection of shade trees, diagnoses the day-to-day problems encountered by our fieldmen. It is this that enables your Bartlett representative, with his knowledge of local conditions, to offer a service that is unique in the field of tree care. Call him today for a study of your tree situation. You will benefit by his recommendations.

REMEMBER

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.

The Bartlett Way

BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana
See your Local Telephone Directory for Local Address.

Mid-Western Utility now

SIXTH FW

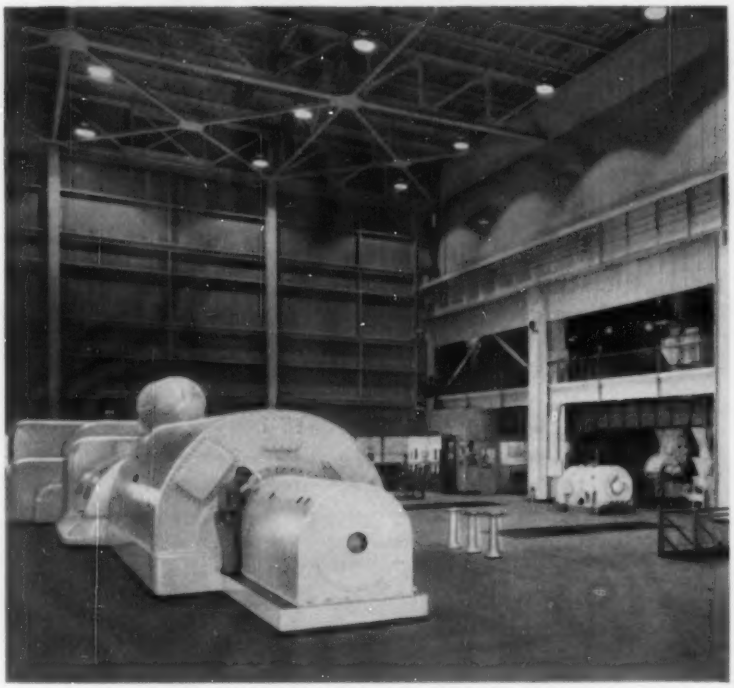
New 853,000 lb/hr reheat unit will bring total FW steam generating capacity on this one system to

4,338,000 POUNDS PER HOUR!

The Foster Wheeler reheat steam generator shown in cross section at the right will serve 100,000-kw Unit No. 2 at a fast-growing steam plant of a large Mid-Western utility. Rated at 853,000 lb per hour, 1800 psi, with 1000/1000 F reheat, it is scheduled to go on line early next year. Work on this plant expansion was already under way when Unit No. 1 went on line in November 1954 — served by an FW 925,000 lb/hr, 1770 psi, 1000F steam generator.

When Unit No. 2 is completed, a total of six FW steam generators, six FW surface condensers and twenty-two FW ball-mill pulverizers will be in service at the various stations of this one Utility.

Repeat orders like this are a positive expression of *confidence* in Foster Wheeler steam plant equipment — confidence that stems from previous *experience*. In major equipment of this type, customer acceptance means satisfaction with the entire job—from planning all the way through to actual operation. Whatever your requirements, it will pay you to consult *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

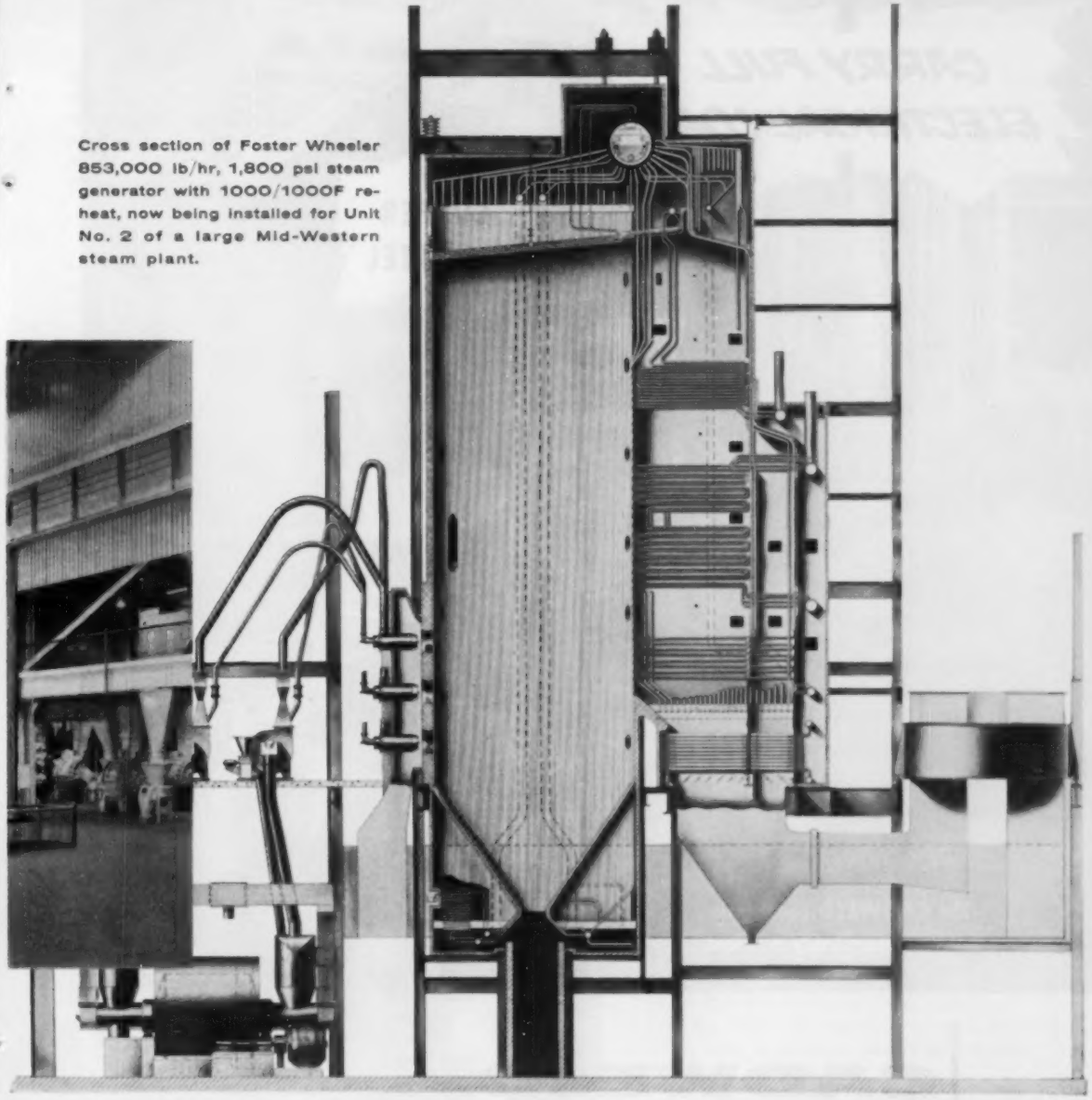


View from turbine floor of unit No. 1, put on line in Nov. 1954, showing 100,000-kw turbo-generator and exhausters of FW pulverizers for 925,000 lb/hr FW steam generator.

LONDON • NEW YORK • PARIS • ST. CATHARINES, ONT.

installing
STEAM GENERATOR

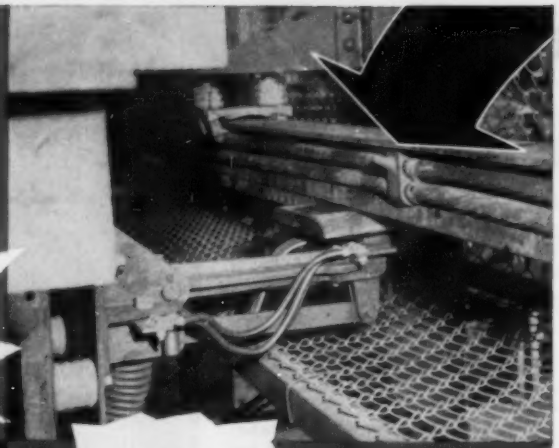
Cross section of Foster Wheeler 853,000 lb/hr, 1,800 psi steam generator with 1000/1000F reheat, now being installed for Unit No. 2 of a large Mid-Western steam plant.



FOSTER WHEELER

CADWELD
ELECTRICAL CONNECTIONS

CARRY FULL ELECTRICAL LOAD



COPPER TO STEEL

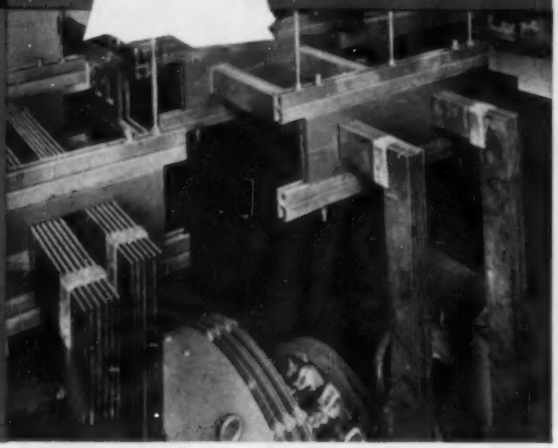
Two-500 MCM booster cables CADWELDED to ore bridge power feeder rail.

LUGS

Power panel with 1,000 MCM cables CADWELDED to ¾" x 2" offset lugs.

BUSBAR

Weld of six—½" x 4" busbars for plating tank installation.



The ability of a connection to withstand overloading is extremely important in any electrical installation. The *CADWELD* Connection is the best in this respect.

When the molten *CADWELD* metal solidifies, the conductors are no longer two pieces *held* together, but one continuous conductor.

The CADWELD connection is 100% electrically efficient.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place • Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

DE LAVAL OPPELLER PUMPS

last longer... cut maintenance costs

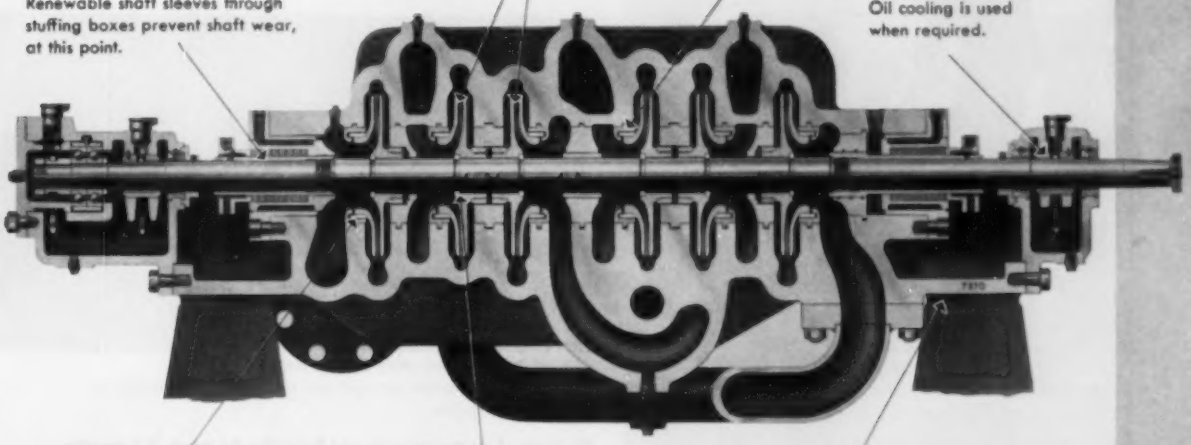
Stages are arranged to reduce differential pressures between stages. This insures permanent sealing at the casing-joint and at interstage diaphragms.

Pairs of back-to-back impellers balance axial thrust. One-purpose thrust bearing carries no radial load, maintains axial alignment.

Labyrinth wearing rings permit safe clearances and reduce wear.

All bearings are ring-oiled, sealed against contamination by water or dust. Oil cooling is used when required.

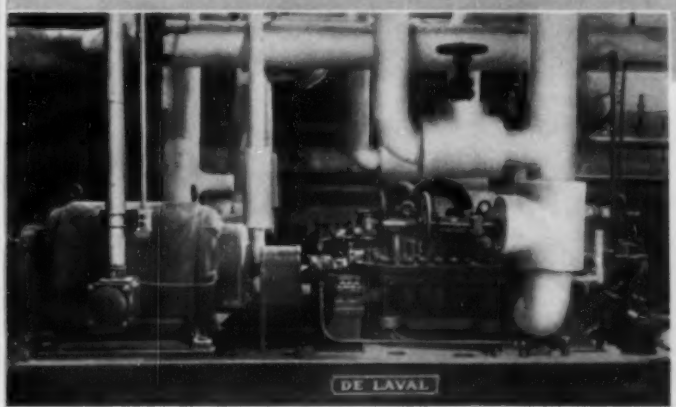
Renewable shaft sleeves through stuffing boxes prevent shaft wear, at this point.



Threaded impeller wearing rings make replacement easy without heating or damage to impellers.

Individual impeller mountings, with split locating rings, make interstage shaft sleeves unnecessary. Impellers can't shift with shaft expansion and contraction.

Casing support insures coupling alignment at any operating temperature.



Here are two De Laval 6-stage Oppeller Pumps used for boiler feed service in an industrial installation.

The design features above show clearly why De Laval Oppeller Pumps stay on the line longer and cost less to maintain. These pumps are used for boiler feed, hydraulic systems, descaling spray, mine dewatering, refinery oil pumping and similar services.

De Laval Oppeller Pumps are available in sizes from 2 to 4 inches and 2 to 8 stages; capacities to 1000 gpm, pressures to 1200 psig and temperatures to 350°F. *For complete data, write for De Laval Catalog 1502.*

DE LAVAL *Oppeller Pumps*

DE LAVAL STEAM TURBINE COMPANY

861 Nottingham Way, Trenton 2, New Jersey

01286

Power company saws through lays *Tiger Brand* Submarine

In she goes. Cable was orginally pulled across the lake with a jeep. The steel armor on cable took up the pulling strain.

Crew of men jockey the cable into position before cutting trench. Mr. Finch says, "We were amazed at the flexibility of the cable."

This is one of the two ice saws used for cutting the trench. It is gasoline powered, mounted on skids.

11 inches of hard ice . . . Cable without boats or barges

• The scene is Upper Saranac Lake, N. Y. Paul Smith's Electric Light & Power and Railroad Company wanted to lay a 2000-foot continuous length of Tiger Brand Submarine Cable under water. Ordinarily this would require expensive boats, barges and crews.

But Raleigh Finch, General Superintendent, decided to wait for a big freeze, saw a slot in the ice, then drop the cable to the bottom. The cable was so flexible, that it only took 15 minutes to unroll the entire 2000 feet onto the ice. The picture captions explain how the job was done.

The cable involved is 2-conductor, 5000V, #4 AWG, steel armored, rubber insulated, non-leaded. It was selected because of its flexibility, light weight and low cost. The cable joins a previous Tiger Brand Submarine Cable that was laid in 1932. According to Mr. Finch, "We haven't had a service failure in that cable since it was laid 24 years ago. In fact, we've never had a piece of Tiger Brand fail, in the 30 years that we've been using it."

Any user of electrical cable can have this same kind of reliable performance. Just switch to Tiger Brand.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS

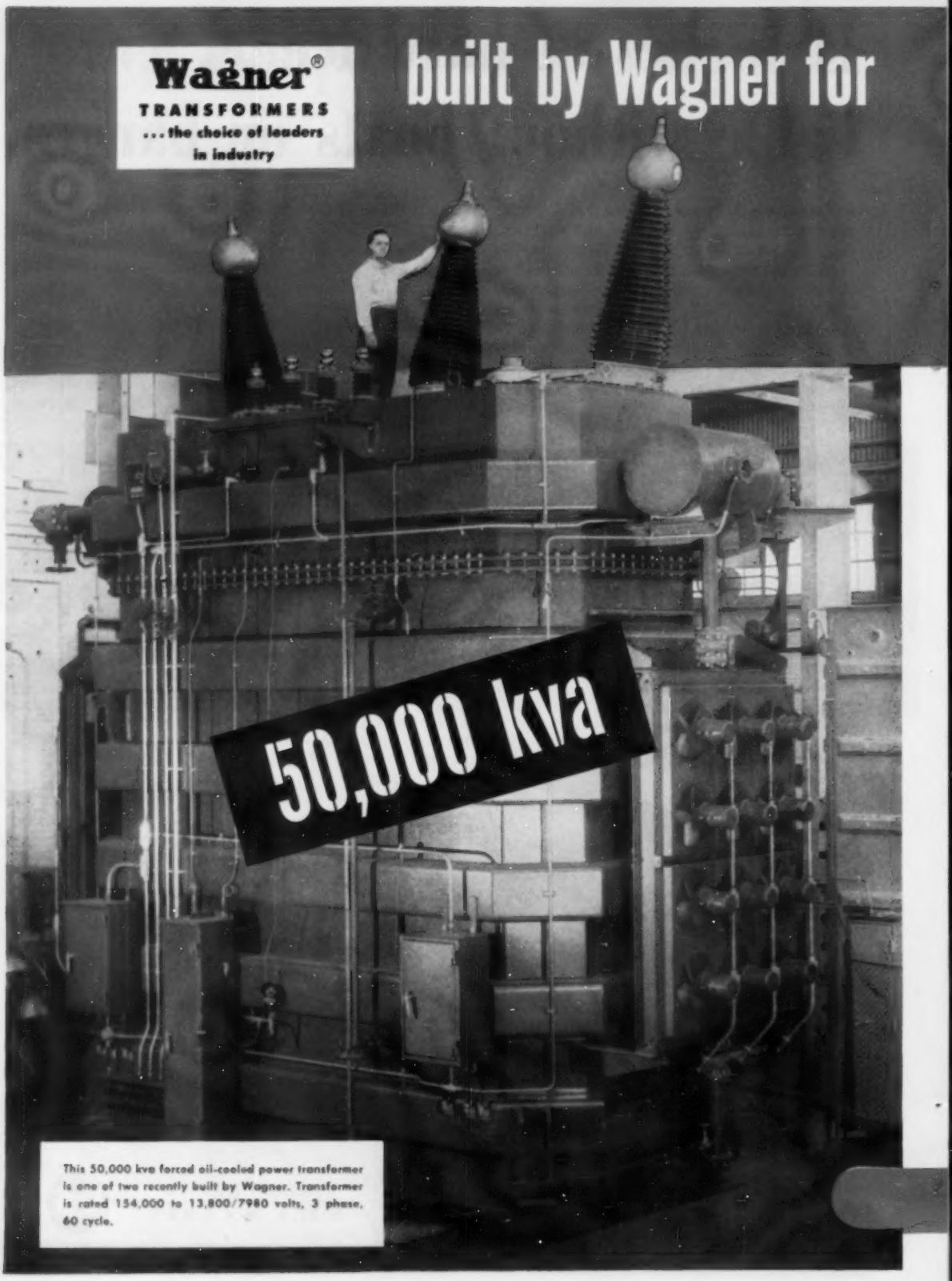
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

- asbestos wire and cable
- mold cured portable cord
- aerial, underground and submarine cable
- shovel & dredge cable
- paper & varnished cambric cable
- machine tool & building wire
- special purpose wire & cable

USS Tiger Brand ELECTRICAL WIRE & CABLE USS

UNITED STATES STEEL


Wagner®
TRANSFORMERS
...the choice of leaders
in industry
built by Wagner for
50,000 kva
This 50,000 kva forced oil-cooled power transformer is one of two recently built by Wagner. Transformer is rated 154,000 to 13,800/7980 volts, 3 phase, 60 cycle.

a large Southern Industrial plant

What do you want in a power transformer?

Wagner can build it!

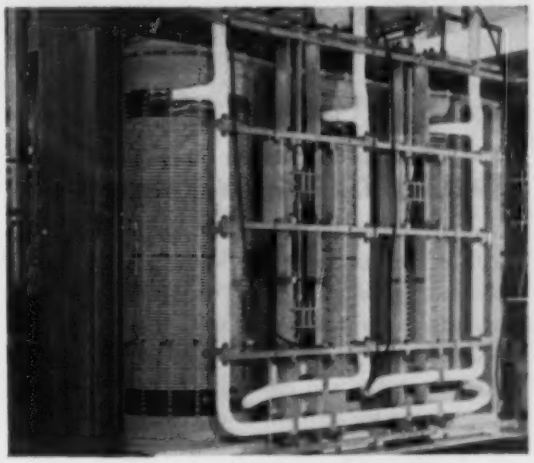
This 50,000 kva power transformer, recently completed at the Wagner transformer plant, is an example of the kind of fine power transformer building that Wagner can offer you.

Wagner has all of the manufacturing facilities and years of experience necessary to build power transformers in the ratings required for modern power systems.

Wagner has been serving the electrical industry for over sixty years. Users like the way that Wagner transformers are designed and the care with which they are built. Wagner design and construction is the reason for the strength and stability of these transformers—gives them the capacity to unfailingly carry their rated loads, and to be able to handle overloads whenever necessary.

Why not consider Wagner Transformers for your next installation? 32 branch offices are available for convenient consultation and engineering service. Bulletins TU-180 and TU-181 give full information on Wagner Transformers. They're yours for the asking.

Every step in the construction of a Wagner Power Transformer gets very special attention. Here, workmen are completing the core for the power transformer shown on the opposite page.



Here is the completed core and coil assembly for this 50,000 kva transformer. These elements are carefully designed and built to fully withstand the electrical and mechanical stresses they will meet in service.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

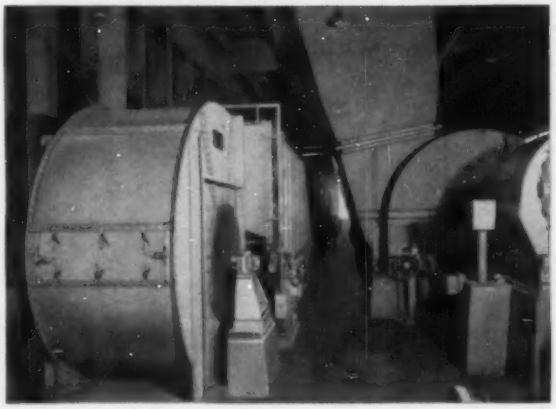
BRANCHES IN 32 PRINCIPAL CITIES

T55-12

INSTANT REPLY TO THE CALL FOR KILOWATTS

SPECIFY DRAFT BY "BUFFALO"

Ever since draft became "mechanized", vital utility stations and plant boiler rooms have been relying on "Buffalo" Draft Fans for that immediate, comforting response to load demands. We've always concentrated on building exceptional long life and reliability into these fans, too, because we know this makes for better and cheaper power production. We call it the "Q" Factor*. It will pay you to write for Bulletin 3750 and see the efficiency, durability and serviceability built into these fans.



The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY

212 MORTIMER BUFFALO, N. Y.

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Built-in cooling system!

Boosts current-carrying capacity 20%

CHASE® VENTILATED SQUARE COPPER TUBE BUS CONDUCTOR!

Natural convection makes the big difference! As temperature rises in Chase ventilated square copper tube bus, cooling air circulates freely through the staggered holes in the tube. Temperatures and electrical resistance stay at a minimum because of this efficient heat dissipation. Excessive local heating, too, is prevented because Chase ventilated bus has rounded corners. And Chase square bus is beam-rigid—mechanically strong in all directions!

Write for *free* Chase Bus Conductor brochure *today*!

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WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper (†sales office only)

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Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
Boston	Dallas	Indianapolis	Minneapolis	Pittsburgh	Seattle
Charlotte†	Denver	Kansas City, Mo.	Newark	Providence	Waterbury

THERE'S A STOREHOUSE OF KNOWLEDGE AT MOLONEY

knowledge gleaned from 60 years of experience in manufacturing transformers . . .

knowledge gained from research . . .

knowledge gained from experience by Moloney's engineers . . .

knowledge that helps Moloney design and fabricate dependable transformers . . .

knowledge that means dependability in service and performance . . .

knowledge that benefits you and your utility system.

MEDS-33

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA

235 Ton Powerhouse Gantry Crane
for Pacific Power & Light Co.
Engineers: Ebasco Services, Inc.

This gantry crane, with its modern, clean architectural lines, is the largest, all-welded box girder crane of its type in the United States. Electric conduits are concealed, yet readily accessible.

Its welded, rigid-frame construction reduces weight and lowers initial cost. Many features lower maintenance costs.

In addition to gantry cranes, Paceco designs and builds cranes of all types, hoists, high-pressure gates and valves, intake gates—all tailored to most economically serve your exact needs. Such equipment has been delivered at competitive prices, nation-wide and internationally. *Your inquiry is requested for preliminary discussion or invitation to bid.*

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

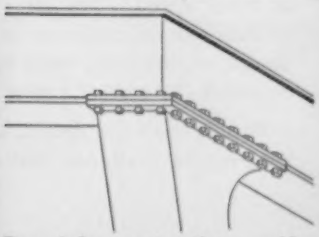
Alameda, California, Lakehurst 2-6100
3018 E. Foothill Blvd., Pasadena 8, Calif., RYan 1-9373

PACIFIC COAST ENGINEERING COMPANY, INC.
51 E. 42nd St., New York 17

PACECO
"TAILORS OF STEEL" ®

IMPORTANT FEATURES

This 235 ton crane employs a single trolley, resulting in 30% to 40% lower first cost. Note the all-welded, rigid frame. It is lighter in weight, hence lower in cost. It assures lasting, accurate alignment of hoisting machinery. Trolley is machined as a single complete unit, assuring minimum maintenance costs; continued operating satisfaction.



Box girder construction provides extra rigidity at lower cost. The rigid frame construction is designed to transmit moments from girder to legs. Fitted bolts in reamed holes are shop aligned, eliminating field alignment and providing lower cost erection in less time

FREE BROCHURE

Send for Paceco's illustrated brochure, "Custom Designed Equipment for Hydro-Electric and Steam Power Plants and Water Works"

Let National Redesign Your Motors and Generators

Old fashioned motors and generators which can't keep up with modern demands. Electrical machines whose performance characteristics don't match changed operating conditions. Don't discard them until you check with National. Often such equipment can be redesigned and rewound to meet your new requirements for a fraction of the replacement cost.

Outmoded equipment can be rejuvenated by the introduction of modern winding techniques. Minor changes in design and materials often make a world of difference in length of life and reliability of service.

Need increased capacity from a generator? Need a motor converted to operate at a higher or lower speed? The table below shows a few of hundreds of instances in which National redesign of old equipment has saved a National customer the cost of a new motor or generator.

Write today for details, or get in touch with your nearby National field engineer.

for:

- **longer life**
- **more reliable performance**
- **increased capacity**
- **changes in voltage, speed or frequency**

Typical National Conversions To Produce New Operating Characteristics

Type of Equipment	Rating before Redesign	New Rating
Steel Mill Motor	1875 HP, 900 RPM, 2200 volts, 3 phase, 60 cycles	1565 HP, 750 RPM, 4160 volts, 3 phase, 50 cycles
Waterwheel Generator	22,223 KVA, 171.4 RPM, 11,000 volts, 3 phase, 60 cycles	27,000 KVA, 171.4 RPM, 11,000 volts, 3 phase, 60 cycles
Motor	125 HP, 600 RPM, 4100 volts, 3 phase, 60 cycles	150 HP, 720 RPM, 2300 volts, 3 phase, 60 cycles
Turbo-generator	1563 KVA, 3600 RPM, 2300 volts, 3 phase, 60 cycles	1563 KVA, 3600 RPM, 480 volts, 3 phase, 60 cycles
Induction Motor	75 HP, 3560 RPM, 220/440 volts, 2 phase, 60 cycles	75 HP, 3560 RPM, 220/440 volts, 3 phase, 60 cycles

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

For cost conscious engineers...

Unique adaptability of Sangamo Type R Current Transformer encourages simple, economical installations

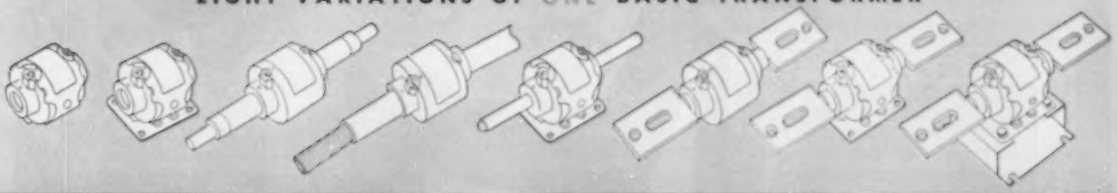
Use this Sangamo (Type R) Current Transformer as a bar-primary-type, a window-type, with or without an auxiliary mounting plate.

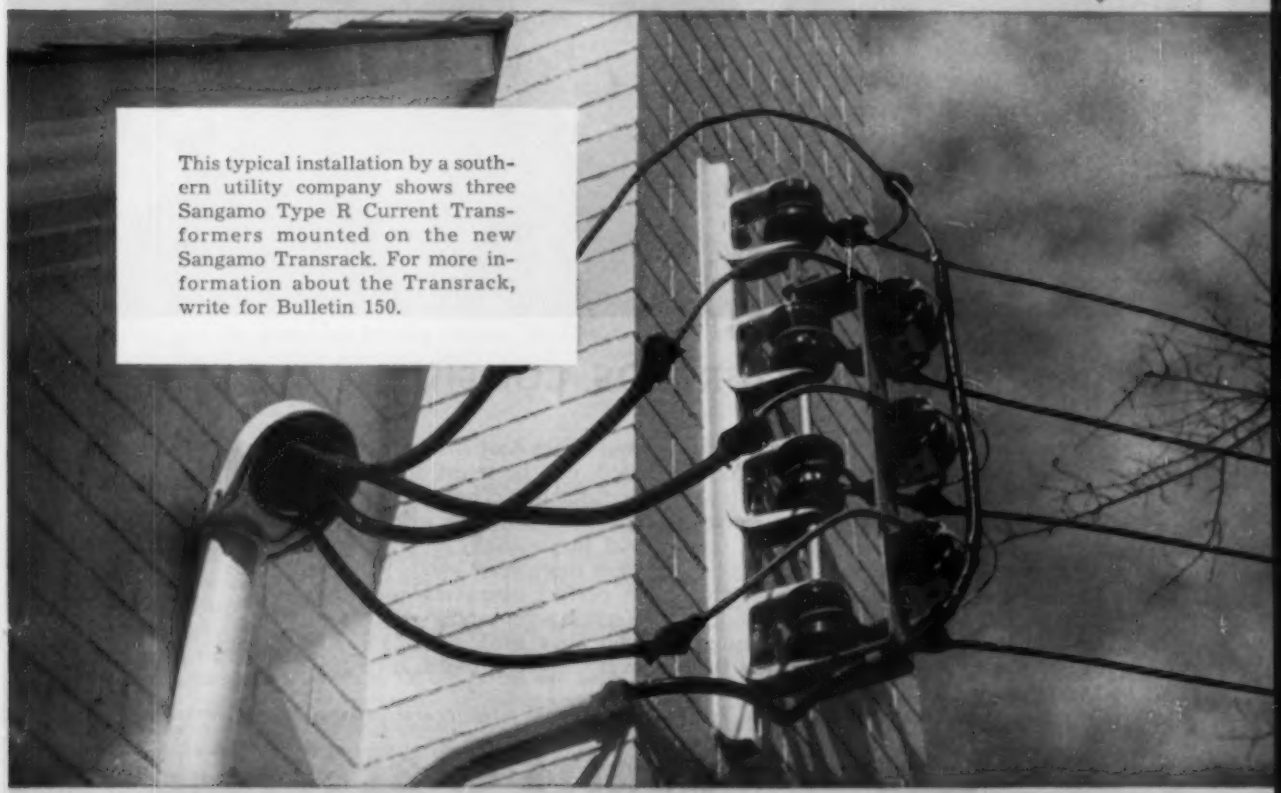
The Type R is light enough to be supported by the primary conductor only.

Type R's are encased in a high impact, phenolic shell, filled with a thermo-setting plastic that eliminates voids and prevents moisture from reaching core or windings.

Full information is given in Bulletin 501... be sure to write for your copy today.

EIGHT VARIATIONS OF ONE BASIC TRANSFORMER





This typical installation by a southern utility company shows three Sangamo Type R Current Transformers mounted on the new Sangamo Transrack. For more information about the Transrack, write for Bulletin 150.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SM954

Prometheus, one of the earliest characters in classical mythology, gave the gift of fire to mortals and was punished for this infringement on the gods. He was bound to a rock to be devoured by an eagle and by the elements. But Prometheus persevered over all. His name still symbolizes enormous endurance over incredible hardship.

ENDURANCE BREEDS CONFIDENCE

Symbols that clearly show unusual endurance over the elements are uncommon. The mythological Prometheus represents strong day-after-day endurance. There's another such symbol, too . . . but not fictional. Kerite Cable, year in, year out, successfully resists the damaging effects of time and the elements. Whether exposed to the humid heat of the tropics, or the rigors of the cold damp Arctic, Kerite, wherever it is used, can be relied on for outstanding performance. That's why there is little cause for surprise when Kerite Cable laid in unusually difficult installations 40 or more years ago is found still to be in perfect operating condition today. Kerite's acceptance is greatest with those who have used it longest. Endurance, over the years, breeds confidence.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

EDITORIALS

On Steam Station Progress

Congratulations are in order to plant designers, power suppliers, and equipment manufacturers for the fine record evident in the returns of Electrical World's Ninth Steam Station Cost Survey (p 127). The achievements are indeed meritorious when one considers that most of the plants reported in this study were built and commenced operation during the inflationary period following the outbreak of hostilities in Korea.

Such things as geographical location and proximity to fuel sources make exacting analysis difficult, but it is possible to back up our praise with some average figures and trends.

For example, engineers designed and built steam stations for about $131 per kw. This compares favorably with the $130-$135 average costs reported in our 1952 survey. Average production cost for all stations is 3.1 mills per net kwhr, compared with 3.5 mills for large stations alone in the 1952 survey. Maintenance expenses are down to 0.20 mills per kwhr or less in 65% of the reporting stations. This compares with 0.25 mills reported in our 1950 and 1952 surveys. In this latest survey total manpower requirements averaged only one employee for every 2.56 Mw. These are but a few of the praisable facts obtained from an analysis of the survey returns.

But before the praise goes too far, it is well to remember that the flattening out of the station heat rate curve as temperatures and pressures go higher is an indication that performance improvement will be more difficult to obtain in the subcritical range.

What should utilities do to continue their progress? Is a wedding between the steam cycle and the gas turbine cycle the answer? Or is it use of supercritical pressure? Or is it nuclear energy?

Formulation of a policy for individual companies will demand the talent and skill of the entire engineering and executive staff. Informed managerial judgment is essential. The main purpose of our Steam Station Cost Survey is to help supply data on which such judgment can be based.

Support Hoover Report

Both as citizens and as electric utility officials you have a large stake in the proposals of the second Hoover Commission report on governmental reorganization. The proposals incorporate economies for a host of federal agencies and operations. The report also contains some nine recommendations aimed specifically at putting federal power activities on a fairer and sounder basis.

Support for the proposals is being organized by the Citizens Committee for the Hoover Report with offices in Washington and New York. Considerable work has already been done in preparing legislative and executive recommendations to be put forward in the next few months. Much is still to be done in preparing the testimony to be submitted in connection with the committee recommendations.

To gain the grass-roots backing needed, the Citizens Committee is organizing state and federal committees for the purpose of familiarizing more people with the purpose of the Hoover Commission work. Enthusiastic help in such organization is coming from business, civic, labor, and other groups. The committee is wary of domination by any single business or other group. It needs financial and organizational support but desires it on a broad basis in order to make its pleas more effective in legislative and executive circles. But utility men can participate.

There is a time element involved. Men working close range on these Hoover proposals fear that some of the impact will be lost unless recommendations are put before the next session of Congress. Publicity and recognition that have been drawn to the Hoover proposals over the last few months will help in gaining Congressional attention early next year. Unless continual pressure is applied, many of the important proposals are likely to end up in some Congressional or White House pigeonhole.

Hugh Thuerk

Friends of Hugh Thuerk, whose obituary appears on page 246, sum up his industry philosophy in a single sentence: Do a good job for your customers, and they will be on your side. This thought is certainly apparent in his progressive, worthwhile contributions to the industry he served for some 36 years.

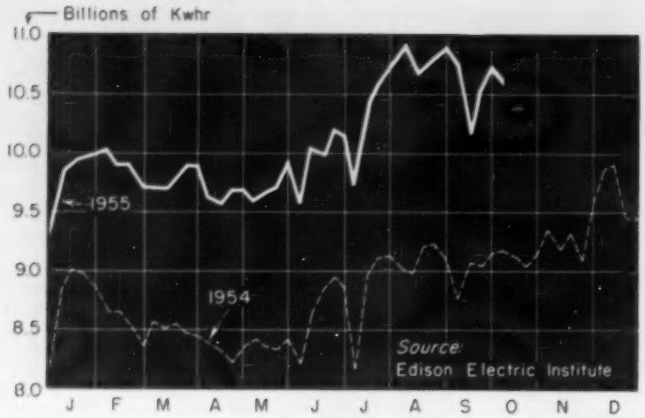
The long-time utility executive won his spurs in helping to build an industrial sales program along modern lines. He took the lead in upsetting the old "come and get it" attitude that pervaded many electric utilities in the twenties and thirties. Instead he advocated and promoted the aggressive sales and service campaigns designed to benefit the customer. These are credited with greatly speeding industrial electrification.

Thuerk had the customer in mind, too, in the executive and employee training programs which he championed. He played key roles in establishing the courses in this field at the University of Michigan and later at Columbia.

Much of his energy and effort was directed through industry organizations to which he gave freely of his ideas and experience. He was extremely active as chairman of the Edison Electric Institute general power committee and was one of the most active members of the institute's post-war planning committee. He served on the board of directors of both EEI and the National Association of Electric Companies and was active in the industry advertising and publicity programs.

It is certain that his capacity for leadership and his counsel would have contributed further to the industry and its customers had not his untimely illness and death intervened.

ELECTRICAL WEEK



OUTPUT

Week Ended Oct. 8
10,639,000,000 Kwhr
Up 15.7%

Atomic Energy Commission requirements — 1,014,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 10.5%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Oct. 8	+15.7	+11.3	+7.5	+27.4	+7.2	+19.0	+8.8	+23.6	+7.8	+10.7
Oct. 1	+16.0	+10.3	+7.6	+26.6	+8.0	+19.4	+12.3	+24.0	+10.4	+9.5
Sept. 24	+18.6	+12.1	+10.6	+30.2	+12.1	+22.3	+14.3	+22.8	+10.6	+10.6

Seasonally Adjusted Index 204.3 Week Ago 203.7 Year Ago 176.7

News Highlights—Rep Sam Coon (R-Ore.) and Sen R. L. Neuberger (D-Ore.) in ten Oregon cities debate partnership development in Northwest . . . Idaho Power speeds Snake River development, orders equipment for two of three dams, saves 30 to 45% . . . Two applications for fast-tax writeoffs turned down, one accepted by Ohio PUC . . . AEC steps up program to control fusion, hydrogen bomb principle, for peacetime power . . . Ralph Besse, Cleveland Electric Illuminating executive vice president, outlines his philosophy of reading as a contribution to learning.

Power Shortage Hits Canada—Driest July and August in 39 years is hitting hydro-strong Ontario and Quebec. In Ontario, Great Lakes Power Corp said additional cuts to industry might have to be added to the 15% reduction now in effect. Quebec industry fears that power stations, which are now tapping reservoirs, will be hard hit come the winter freeze-up unless heavy rains fall before early December.

Hot Research—A $60,000 research program on heat dissipation characteristics of soils as they affect load capability of underground lines will be sponsored by AIEE's Committee on Insulated Conductors. Dr Hans F. Winterkorn of Princeton University will conduct the three-year program.

Atomic Power Advances—Prototype atomic engine for USS Nautilus will be refueled and modified soon, says Westinghouse Electric, after 2½ years of nearly continuous operation. It is expected to reveal first operational knowledge of consumption rate of fuel elements in a PWR. . . . Nuclear power will account for 40% of Britain's electricity by 1975, estimates Anthony Nutting, Britain's Minister of State.

APDA Makes New VP's—At recent annual meeting of Atomic Power Development Associates in Garden City, Long Island, N. Y., Walker Cisler, president of APDA, announced the election of the following vice presidents: K. M. Irwin, vice president, Philadelphia Electric, succeeding R. G. Rincliffe, president of the same company; John R. Coffin, Jackson & Moreland, engineers, and James F. Fairman, vice president, Consolidated Edison Co of New York. Andrew A. Kucher, director of scientific research laboratory, Ford Motor Co, was named a director.

Pennsylvania Strike Ended—UWUA-CIO strike against Pennsylvania Power Co has been called off. Both parties agreed to submit a seven-point program to arbitration.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire—Sale of Clark Hill power to Georgia co-ops, rather than to Georgia Power Co, was dictated by a July 15 opinion of U. S. Attorney General. Assistant Interior Secretary Fred G. Aandahl revealed the contents of the Justice Department ruling to the House Subcommittee headed by Rep Earl Chudoff (D-Pa.). Aandahl said opinion was requested as the department prepared to sign an agreement with Georgia Power under the tri-contract proposal. The attorney general warned that an offer of sale must be made the co-ops before government signing of the tri-contract arrangement would be legal.

Still No Pay for Dixon-Yates—Settlement payment of abandoned Dixon-Yates contract is being held up while its validity is investigated. AEC Chairman Lewis L. Strauss said last week, "It appears on the basis of our study thus far that there may be a question as to the validity of the . . . (Dixon-Yates) contract."

EEI Area Development Committee Workshop—Judge J. W. McAfee, president, Union Electric of Missouri, told meeting in St. Louis last week both area development and atomic power development are long range. Effort put into them, he said, may show no effect for years and years on balance sheet. Yet on other hand we cannot afford to stay out of either program . . . C. M. Wallace, vice president, Georgia Power Co, said: "Area development for electric utility is an invaluable public relations builder as well as an insurance policy . . . Dr Paul Brann, director industrial research center, University of Arkansas, said area development is now recognized as a proper function of utility companies. "You have added weight of your industry to other institutions concerned with improving levels of lives of people in the community."

11th CEMA Meet—From Canadian Electrical Manufacturers Association's 11th annual meeting at Niagara Falls: Domestic production by electrical manufacturers for 1954 was $986,791,000, a 1.3% increase over 1953 . . . profit was 2.6% in 1954, against 4.0% for 1953. Outlook: more low profits . . . reason: low import prices.

Copper Prices Slide—Refined copper fell 4½¢ a lb to 45½¢ a lb, compared with 43¢ at primary producer level. Outlook: lower prices, say metal experts.

Obituary—Ernest L. Godshalk, 59, vice president in charge of operations of Kansas City P&L, died Oct. 11 at Kansas City after a heart attack.

ABOUT PEOPLE IN THE INDUSTRY

Speaking at the PIP Workshop Conference in St. Louis, Harllee Branch, Jr., EEI and Georgia Power president, urged public relations executives to take a strong and positive stand on the side of telling story of the industry and the American way of life. In attempting to solve these day-to-day problems "with a slipstick and a wattmeter," he said, "we have neglected those relationships which cannot be measured mechanically but which can be measured in the manner of popular support and public acceptance."

If public power sponsors succeed in obtaining state development of additional power resources at Niagara Falls "private enterprise, as typified by your industry (electric companies), will have suffered its severest blow," Rep William E. Miller (R-N.Y.) told Public Information Program Workshop Conference. For this step "will be the first time in all history of the public power controversy that government, federal or state, has undertaken a pure power project," he declared.

More News About People page 242

On ten-day tour of ten Oregon cities, Rep Sam Coon (l), Republican, and Sen R. L. Neuberger (r), Democrat, pinpoint authorship of John Day Dam legislation as . . .

Partnership Policy in NW Debated

Pros and cons of partnership power policy have crackled like short circuits across Oregon as two Congressmen chose platforms at the grass roots to argue their views on legislation for the John Day Dam on the lower Columbia River in Oregon.

The two principals were Republican Rep Sam Coon (Ore.), sponsor of John Day partnership legislation for a group of local utilities, and federal power partisan Sen Richard L. Neuberger, Portland Democrat.

As their ten-day debate, involving stops in ten cities, continued, the authorship of John Day Bill, sponsored by Coon, evolved as the dominant issue. Neuberger first challenged Coon at Pendleton to name the author.

Coon, however, continued to flay away at the preference clause and its effect in the Northwest. Preference, he said, was giving Washington state neighbors a larger percentage of Columbia River federal generation because Oregonians prefer investor-owned utility service. As a result, the Republican legislator declared, power users in Oregon face uncertain supply.

"Right now," Coon stated, "a beer parlor in Pasco (Wash.) can get current when a hospital in Pendleton (Ore.) cannot."

When Neuberger linked the preference clause to the Bonneville Power Administration Act, sponsored by the late GOP Sen Charles L. McNary, Coon declared that the BPA bill had been prepared by Franklin Roosevelt's New Dealers.

McNary, Coon said, "had to take it as it was, and he took it."

On John Day legislation authorship, Neuberger declared, "I say flatly that private utility interests authored the bill and gave it to Coon to introduce. And I challenge the Congressman to deny it."

Later Coon explained the bill was a product of consultation with federal agencies, Republican colleagues, and electric industry experts.

In Klamath Falls, Neuberger asserted that the author of the bill had been Kinsey M. Robinson, president of Washington Water Power Co, one of three companies offering advance payment energy to get the project started.

Via his Spokane offices, Kinsey Robinson stated that Neuberger "was talking through his hat as usual." And he added, "Certainly Congressman Coon did consult with the three private utilities involved" and representatives of "several public bodies." "How else," Robinson asked, "could he (Coon) be assured of financing and participation of both public and private agencies?"

Kilowatt Cost Argued

John Day's probable kilowatt costs figured in all discussions. Neuberger insisted the region needs low rates which he says are only possible with low-interest federal-financed projects such as that permitting 2.5 mills of wholesale Bonneville power.

On the other hand, Coon has argued that the region needs 1,105,000 kw from John Day as quickly as possible and that the retail cost to customers is not a critical factor.

At one point Coon declared, "I am for private enterprise from the peanut vendor to large industry. Private industry is what made this country great."

"My bill," Coon said, "provides for the local interests, public or private, that are in the utility business to advance money instead of taking it out of the hides of you taxpayers. And that certainly is in the public interest."

Coon plans to continue speaking on partnership policy this fall in his home area. His talks, laying a base of understanding and providing a clear appraisal, should work in favor of advocates for investor-owned development and utility service in the Northwest.

U.S. Bureau to Start 4 Hydro Projects

Bureau of Reclamation, in the next six months, will issue invitations for bids on four new starts authorized by Congress last session. When completed, the structures will add 449,250 kw to the federal power system.

To begin with, an invitation to bid on the 5,000-kw, $1-million Deer Creek power plant and switchyard of the Provo River Project, Utah, was set for issue today. And Bureau's Denver engineer set a schedule for the following bid calls on power projects:

November—Roza Power Plant, Yakima River Project, Wash., an 11,842-kva generator and powerhouse on Roza main canal near Yakima.

December—Yellowtail Dam and Power Plant, Missouri River Basin Project, Mont. Bureau has $4 million to start this $90-million, 200,000-kw project on the Big Horn River.

March, 1956—Trinity River Dam diversion tunnel, Central Valley Project, Calif. With $1 million to work with this year on this $219-million project, the Bureau will ask bids on a 3,500-ft-long tunnel near Minersville, where there will be ultimate installed capacity of 233,000 kw.

Hells Canyon Work Speeded

. . . with $13,620,000 in equipment orders for Brownlee and Oxbow; Idaho Power awards contracts to Westinghouse, GE

Idaho Power Co is moving ahead with development plans for the Hells Canyon reach of the Snake River. T. E. Roach, president of the utility, recently announced the company has placed equipment orders totaling $13,620,000 for Brownlee and Oxbow projects.

Because of "keen competition by manufacturers," Roach said, the orders reflect savings of 30 to 45% on previously estimated costs (EW, Aug. 15, p 8).

Westinghouse Electric Corp has been awarded a contract for eight generators, four for each Brownlee and Oxbow. General Electric Co will supply transformers and switching equipment comprising the bulk of other items ordered at this time. Transmission line materials costing $1.5-million are included in the equipment orders.

"We want to have the projects in operation as rapidly as possible. . . . Fitting the manufacture of major electrical machinery into future production schedules at this time assures the company of prompt delivery at anticipated dates of installation," the Idaho Power Co president explained.

Idaho Power is now awaiting Federal Power Commission's approval of recently revised plans for the two power houses. Last month the utility asked FPC for permission to make a change in building materials and to construct Brownlee and Oxbow simultaneously (EW, Sept. 26, p 9).

Manufacturing schedules will permit delivery of Brownlee's four 90,000-kw generators within 14 to 20 months. Generators furnishing Oxbow's 151,000 kw are slated for delivery within 12 to 15 months after start of construction.

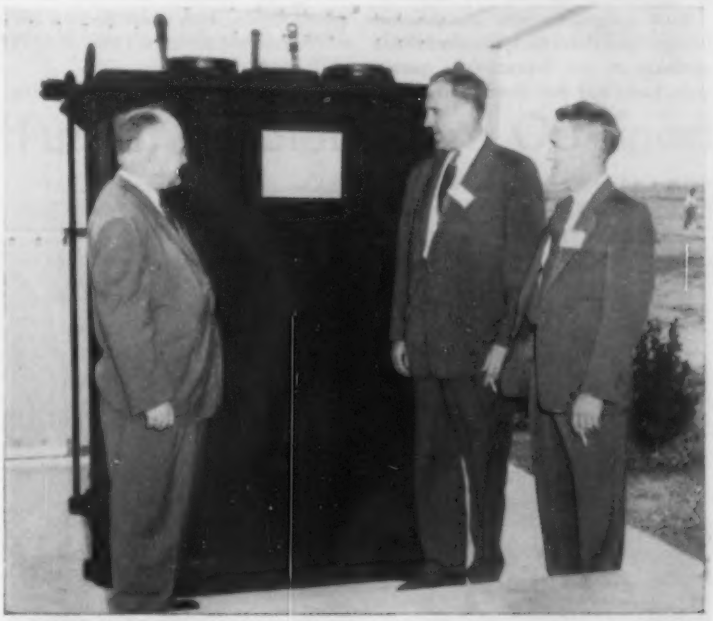
World Hydro Development Hiked 460% Since 1920

The U. S. Geological Survey has just released a report showing that hydroelectric development in the United States increased 460% between 1920 and 1954.

The report, Geological Survey Circular 367, summarizes development in Western Europe, Australia, New Zealand, Japan, and many South American countries, as well as the U. S. It also includes information on undeveloped waterpower potential in these areas.

Some of the highlights of the report are:

- Water-power development for the world increased 564% from 1920 to 1954. Early development of U. S. resources accounts for the lower rate, 460%, of U. S. increase.
- Africa has the greatest hydro potential and smallest installed capacity. But, as in Asia, where great potential is centered on northern rivers, attempts at development would encounter "almost insurmountable obstacles because of inaccessibility and remoteness from . . . points of use."
- Development in all countries is continuing at an unprecedented rate for market has outstripped supply.
- Installed capacity of world waterpower plants was 130-million hp at the end of last year. U. S. had 35-million hp, or 27%, of this.
- Installed capacity of water wheels increased nearly 107-million hp since 1920.



GE's Oldest Transformer Retired

A 52-year-old transformer has been retired in splendor atop a pedestal at General Electric Co's Medium Transformer Plant at Rome, Ga. Erection of the new monument marked the end of GE's "treasure hunt" for the oldest of its transformers still in operation.

Still supplying electricity for a cement plant, the winning transformer was found at Pacific Gas & Electric Co's substation near Santa Cruz, Calif. It was built in 1902 by Stanley Electric Manufacturing Co, which later became a part of GE. Originally installed in San Francisco, the transformer weathered the 1906 earthquake and had never undergone any major repairs.

Shown beside the venerable "monument" above are (l to r) C. B. McManus, president of Southern Co; W. S. Ginn, general manager of GE's Transformer Division; and D. B. Lawton, manager of GE's Medium Transformer Plant in Rome. Lawton officiated at dedication ceremonies.

3 Fast Depreciation Orders

. . . issued by Ohio PUC; applications of Cincinnati G&E and Ohio Power rejected; Cleveland Electric Illuminating okayed

In three orders of considerable importance to the electric utility industry the Public Utilities Commission of Ohio denied the application of both Cincinnati Gas & Electric Co and the Ohio Power Co for use of normalized taxes and restricted surplus arising from accelerated depreciation and gave a heavily qualified approval to the Cleveland Electric Illuminating Co to use a reserve method of accounting for the tax deferral.

Both Cincinnati G&E and Ohio Power proposed to the PUC that they be permitted to use normalized taxes and the "restricted surplus method" of accounting for the tax deferral.

Both companies took the position in their petitions that the liberalized methods of tax depreciation merely defer taxes and that there is no fundamental difference between it (Section 167 of the Internal Revenue Code) and the tax deferment arising from the Amortization of Emergency facilities (Section 168).

PUC's answer to the company's position was to quote liberally from the report of the National Association of Railroad & Utilities Commissioners Committee on Accounts and Statistics (the so-called A. R. Colbert Report).

The commission noted that:

"On the other hand, the NARUC Committee on Accounts and Statistics in its report points out dissimilarity between accelerated amortization of emergency facilities and the accelerated depreciation under Section 167 of the Internal Revenue Code of 1954 as follows:

"At the outset, the tax effect of the liberalized depreciation charges must be distinguished from the tax savings under the five-year amortization emergency facilities under Section 168 of the 1954 Revenue Code (Section 124A of the Revenue Act of 1950). The latter procedure results in a saving for a definite five-year period and it is normally to be expected will be followed by a period of higher tax payments. In contrast, liberalized depreciation results in tax reduction for an indefinite period of time which may be very long, and in fact, may be continuous."

The commission is of the opinion that new and different problems arise in the application of the accelerated depreciation provisions under Section 167 of the Internal Revenue Code of 1954 that were not present in the application of the provisions of the Internal Revenue Code for accelerated amortization of emergency facilities.

The PUC concluded that:

"The commission is of the opinion that authorizing the Ohio Power Co

(*Continued on page* 250)

Portland GE Plans Clackamas Project

Portland General Electric Co plans a $19-million hydro development on the upper Clackamas River in Oregon's high Cascades which will add 75,000 kw of capability to the company's 91,000 kw of generation on the stream. The project, as sketched by Ebasco Services, is shown above.

Board Chairman Thomas W. Delzell reported that a concrete arch type dam at the North Clackamas site, which has been under investigation for several months, would develop 135 ft of head and have a powerhouse with two 25,000-kw generators. The other 25,000 kw of capability will be installed at the downstream Faraday powerhouse which now has a rated capacity of 19,000 kw. Delzell said preliminary applications would be filed soon.

3 Atomic Power Plants Slated for Latin Nations

Three 10,000-kw atomic power stations have been slated for installation in Latin American countries by American & Foreign Power Co, Inc.

Designed primarily for regular power needs, the stations also will be used for training and research.

Locations of these three plants cannot be set until Latin American diplomats conclude bilateral agreements with the U. S. and authorize Foreign Power to construct them. But the announcement sparked enthusiastic speculation in Mexico where Puebla was suggested as a suitable site conveniently close to Mexico City and its large university.

A&FP is contemplating purchase of each reactor and its related equipment from a different manufacturer. Ebasco Services, Inc, will handle plant design and construction.

Necessary capital will be provided by A&FP, and company officials expect the nuclear plants to be in operation in about three years. Plans for the Latin American development already have been discussed with the U. S. State Department and the Atomic Energy Commission.

AEC Steps Up Its H-Power Program

An almost limitless new source of power, using fuel "mined" from the sea, is the subject of a program just beginning pushed-up operation at the Atomic Energy Commission.

Fusion of light elements is the energy source; hydrogen, the fuel. The problem—to control the fusion process.

Concrete Results Are Distant

At a recent press conference, AEC Chairman Lewis Strauss, Commission Member Willard F. Libby, and a panel of AEC staff experts discussed the U. S. program to control the thermonuclear reaction. Here are some of the things they said about it:

• The program represents the first concentrated effort in this country to evolve even the theory of regulated fusion. It's only three years old, and probably scores of years of work remain before we can actually experiment with the process, except on paper.

• The U. S. program has competition abroad. This will speed its progress. It has already pushed fusion to the status of a major AEC program.

• Since concrete results appear so far away, AEC sees no competition in the near future between fusion and fission power plants. AEC Reactor Chief Kenneth Davis agreed with Strauss that most nuclear power plants using fission as a source of power will be completely amortized before the advent of fusion power on a practical basis.

Private Enterprise Must Wait

• Eventually, there will be a place in the U. S. program for private companies. However, while the program is still in the experimental stage, only selected scientific specialists are being asked to contribute.

• Although the problems still to be solved are formidable, the benefits would be fantastic. Millions of degrees of heat are needed to create fusion, but energy unleashed would be greater. The sea abounds in fusion fuel—enough hydrogen to supply far more than the world's present need for power over a period of millions of years. Radiation hazards which complicate fission technology are not encountered with fusion. There are indications that fusion energy may be eventually converted directly into electricity, without going through the traditional heat-steam-generator cycle.

Strauss emphasized the infancy of the program. He conceded that it was possible for science to score a major research breakthrough within 20 years; but he added that he would not be surprised if it took longer, either.

"It cannot be stressed too strongly that, based on what we know now, we are far from a solution of the problems of the controlled fusion reaction," Strauss said. "Our work is in the research stage and many years of intensive effort may be required before the first prototype of an operating thermonuclear machine may be developed."

The American fusion program first came to light in August, when India's Dr Bhabha revealed at the opening session of the International Conference on Atomic Energy that the most advanced atomic nations were engaged in fusion research. Strauss at that time disclosed that this country had been working on the problem; he amplified this recently.

The work here, as in other nations, is entirely theoretical. Chief among its participants are theoretical physicists, physical chemists, and mathematicians. They are based primarily on college campuses, although AEC is overseeing and coordinating their work. Involved are some of the world's most prominent university researchers.

The program does not have much money, as atomic energy programs go. The specific amount is classified, but there's been a 200% step-up in the fusion budget for current fiscal year.

Fusion Problems Are Outlined

The scope of the problem which the AEC hopes to solve in its stepped-up program to harness the fusion process for peacetime use has been indicated by two men associated with the project.

Chancellor Henry T. Heald of New York University where fusion research is being conducted said:

"The fusion process can only take place at extremely high temperatures (hundreds of millions of degrees). Means are needed to hold the fusionable material in place while the process is under way. It is essential for these purposes to understand the laws which govern the behavior of matter under extreme conditions. Existing theories have not been applied in the past to such conditions and cannot easily be extended. It has been found necessary to re-examine fundamental laws and to formulate new theories and develop new mathematical methods in order to obtain an insight into the mechanism of maintaining a stable configuration of heated material for a . . . long period of time."

Princeton University's Professor Lyman Spitzer, Jr, who touched off the AEC program with an idea for fusion control in 1951, outlined the problems involved as follows:

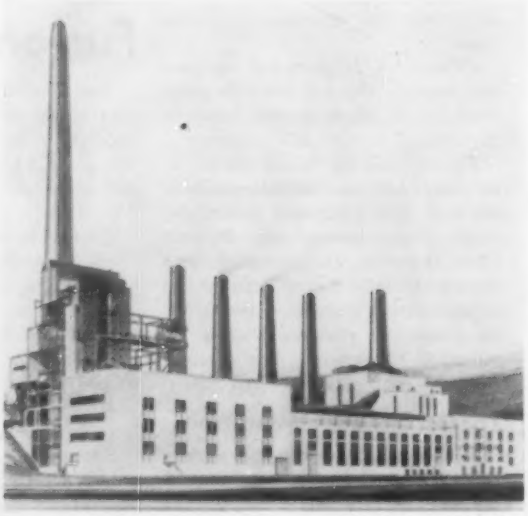
"Thermonuclear burning occurs most readily with deuterium, a heavy isotope of hydrogen. Although only one deuterium nucleus is present in water for every 6,400 nuclei of ordinary hydrogen, the total amount of deuterium available in the oceans is enormous. If the energy stored in these nuclei could be released in a controlled manner and used for generation of electrical power, a virtually inexhaustible supply of power would be available to mankind. Conservatively estimated, the deuterium in the ocean's waters is sufficient to provide many times the present rate of world energy consumption for more than a billion years.

"Thermonuclear burning occurs only at enormous temperatures, above 100,000,000F. Such temperatures and higher have existed only at the centers of very hot stars or during the explosion of an atomic bomb. To convert the inexhaustible supply of energy in the earth's deuterium into useful power, we must achieve such temperatures in a gas confined within walls that remain relatively cool. We must control the thermonuclear reaction when it occurs. We must extract the energy released and use it to generate electricity. The scientific and technical difficulties . . . are formidable."

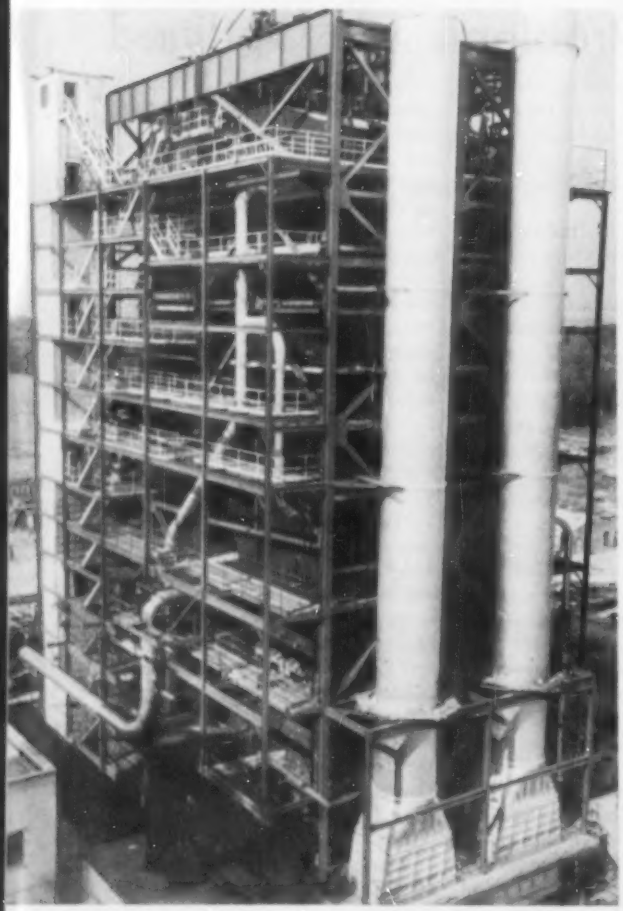
MORE POWER for upstate New York was recently generated when New York State Electric & Gas Corp's Milliken Station spun its 135,000-kw unit

BREAKING GROUND for 100,000-kw Cherokee Station at Denver is handled by J. E. Loiseau, president, Public Service Co of Colo. Other officials look on

More Kilowatts



NEW 225,000-Kw UNIT is being planned by Appalachian Electric Power Co for its Glen Lyn Plant. The $26-million addition, shown at left in artist's sketch, will have the first outdoor boiler and the tallest stack, 430 ft, in Appalachian's system. It will raise plant capability to a total of 395,000 kw

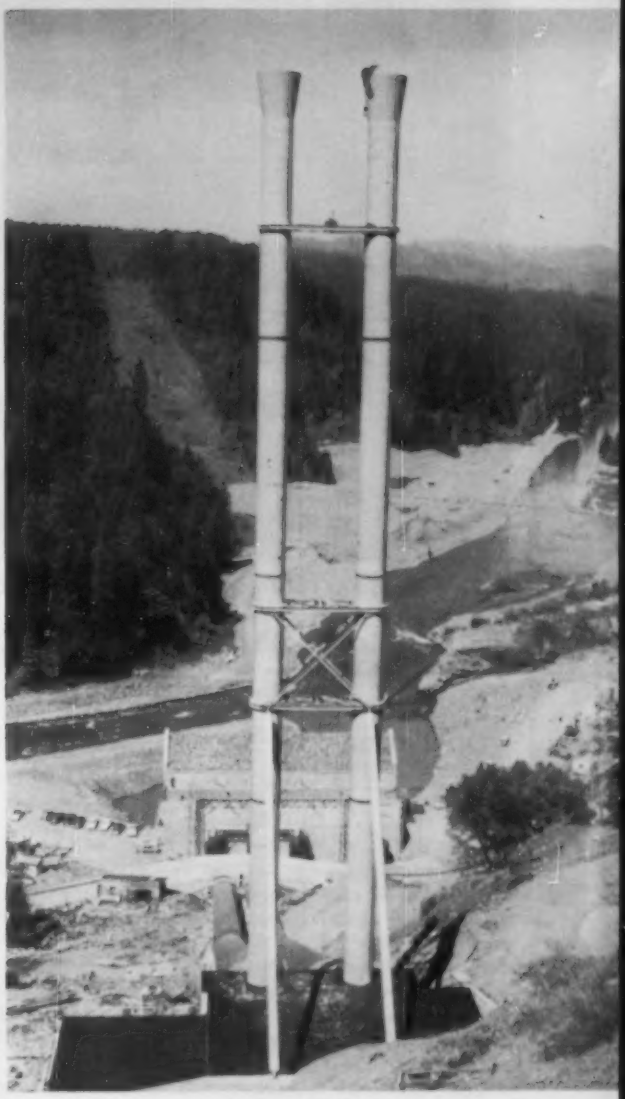


BIG BOILER goes up for 135,000-kw unit at Louisiana Power & Light Co's Ninemile Point Plant, located near the Huey P. Long Bridge across the Mississippi River above New Orleans. The new unit boosts total plant output to 319,000 kw at LP&L's Ninemile Point

OUTPUT HIKED 110,000 kw with addition of new unit at Urquhart Plant of South Carolina Generating Co, subsidiary of S. C. Electric & Gas Co

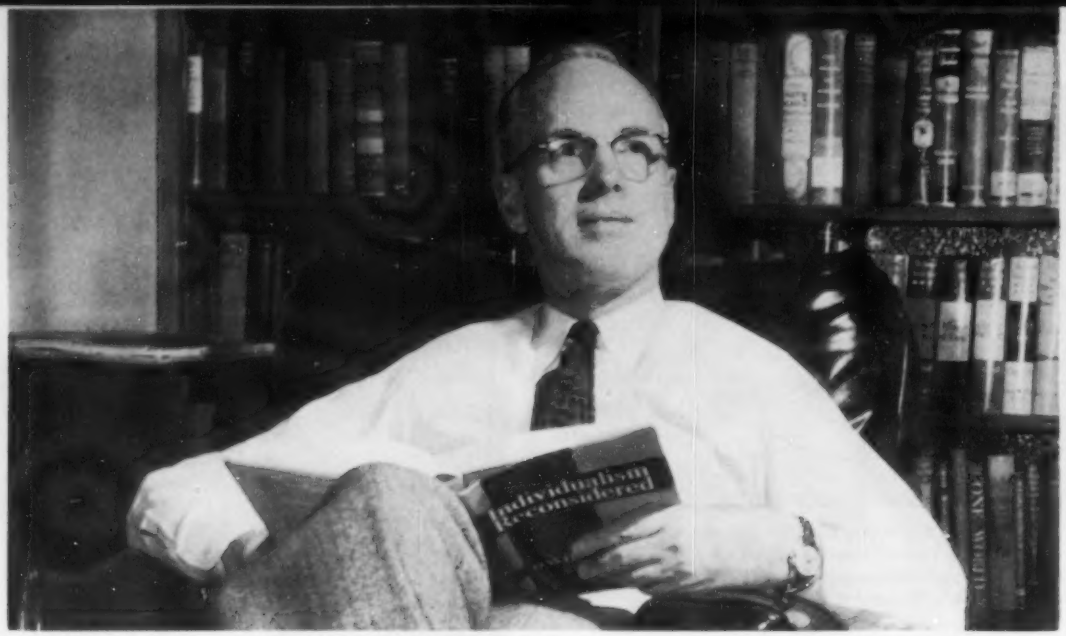
in the Making

DOUBLING PLANT SIZE is new 66,000-kw installation now being constructed at Central Power & Light Co's Lon C. Hill Station near Corpus Christi, Tex. Steelwork construction, almost complete, is shown in progress picture. Project completion date has been set for the first quarter of 1956



COMPLETED PIT 4 project of Pacific Gas & Electric Co added 84,000-kw to system. Standpipes tower over plant on Pit River in northern California

PLANT DEDICATION heralded completion of 135,000-kw Bay Shore Station built by Toledo Edison Co on Lake Erie at Harbor View. The new project, located on a 400-acre tract and costing $30 million, rises 13 stories high. Construction was started in 1953



Ralph Besse Practices What He Preaches . . .

Educate Yourself for Life by Reading

MANAGEMENT
Industrial Relations

Executive vice president of Cleveland Electric Illuminating Co devotes meeting of department heads to his philosophy

Ralph M. Besse, executive vice president of Cleveland Electric Illuminating Co, does not consider it remarkable that he should take up the entire monthly department head meeting of the company with a discussion of reading. When Besse did this at such a meeting he said, "As far as I know, a group like this (there were about 45 present) has never spent half a day discussing the general philosophy of reading. It doesn't disturb me that nobody else has done this; I like to think that the Illuminating Co does a lot of things first."

CEI places a lot of stock in reading by its employees and has a number of reading services for them. Besse has done much to see that they are used. The company's library information service, for instance, scans about 200 incoming magazines and mimeographs brief summations of the articles which they think will be of most interest to CEI people.

But when addressing the department head meeting, Besse was aiming at a much broader field. He covered the subject of reading as thoroughly as it could be covered by anyone in the space of one meeting. The transcript of his remarks runs to a 76-page mimeograph document. The material that went into the discussion resulted from four to five months of research, and it took Besse an entire summer vacation to put his notes into shape.

Why did a top utility executive go to all this trouble? Part of the answer lies in Besse's remarks to the meeting. He told the group, among other things:

"If we get two people out of this group who substantially change their habits for the better in the field of reading, it will have justified the time spent by all of us. If we get a 10% improvement in reading on the average across the board here, it will more than justify the time that all of us are spending here this morning. And if anybody goes out of here with the inspiration to get the people who report to him to read, that too will more than justify the time that is spent here this morning.

Besse also noted that he had appointed a special committee to review the subject of management improvement techniques. The committee listed fifteen. Reading was third in importance on the list. Furthermore, says Besse, CEI keenly felt the need of broadening the scope of its highly specialized personnel. And, he adds, he wanted to "let our supervisors, and through them our employees, know that the company does not frown on liberal arts."

Besse told the meeting that morning how the late President F. D. Roosevelt once asked Justice Holmes: "Mr Justice, why do you work so hard at this reading business?" Holmes replied, "Well, I know of no other way to improve my mind."

"Holmes recognized a number of things in that rather sage remark," said Besse. "One was that the subject of education is a continuous process. You don't become educated at college. You are merely prepared for an education. To be an educated person, you must study continuously as long as you live, and Holmes knew that. The second thing he recognized was that to achieve mental improvement (or education by our definition) you have to do it yourself. Education is a self-improvement process. Nobody can educate you. You have to educate yourself. And that, of course, is one of the reasons that we are having this program, because the third thing Holmes recog-

nized was that the best way to educate yourself is by reading."

The executive made it clear to the group that his discussion of reading referred to optional reading, reading over and above the reading that is required at work. He gave each of those present at the meeting a questionnaire to fill out on their reading habits. This is not for a "personal checkup on anybody, but I would like to know what the status of reading is in this group so that perhaps a year from now we can take another look to see whether or not we have improved our reading and find out whether this was a valuable thing to do," said Besse.

Besse then went into detail on the various phases of the techniques of good reading. Extracts of his remarks on these phases which follow have been taken from the transcript of the meeting:

Why Read

I make some basic assumptions in this discussion. One is that you believe education is a good thing. Second, I assume that you are willing to assume your responsibilities for good citizenship—that you want to be a good citizen and that you want to do the things essential to make you a good citizen, wholly aside from your job. Third, I assume that you would like to improve your present job performance. Fourth, I assume that you want to prepare yourself for a better job.

The one thing that is common to all of these is learning. Most of us just cannot possibly find the time available to learn things by taking courses of instruction all of our lives. And so that brings us back to reading as the most valuable method of learning.

Why is reading the key to learning?

- It is the most complete source of learning.
- It is the cheapest source of learning.
- It is the most available source of learning.
- It is the quickest source of learning.
- It is the most current source of learning.
- It is a simultaneous source of multiple learning (because you learn more than one thing from good reading).
- It is a method of continuous personal training for self-improvement.

Why should any executive or top specialist be interested in the depth of learning to become a "full man." I think perhaps most of us do a good job in keeping up to date on the basic technical learning. But, as we move into a higher area of responsibility, we find ourselves in so many areas that require knowledge of things in addition to our technical skill, that if we don't try to get some breadth in our learning, we fall by the way side.

For example, everybody here ought to know something about accounting, taxation, depreciation, regulation, finance, engineering, economy, industrial psychology, public relations, purchasing, and marketing.

And on top of all the reading requirements for job performance alone, we certainly need to have a pretty good understanding of the broad base skills of management. That's a broad reading field in itself: forecasting, planning, controlling, communication, training, organizing, selecting people, selecting methods, reviewing and appraising people, reviewing and appraising performance, fixing salaries, making decisions—all these things are direct job requirements in a broad sense. They indicate why the reading matter of the top executives, shown in the surveys I referred to, includes so much material on management and business.

Knowing what goes on in the world around you, I think, is a job requirement too. It certainly is a citizenship requirement, but it is also a job requirement if you think of your job in broad terms. Good citizenship requires knowledge of some general fundamentals in such areas as history, politics, economics, sociology, geography, science, and many others. It is clear to me that good supervision requires some knowledge of these things too.

I would not want the case for reading to rest exclusively on its commercial value or its personal advantage factors. Executives, by virtue of their preferred position in society, assume some responsibilities to society that are above and beyond the commercial aspects of their occupation. All of us have an obligation to contribute to the cultural improvement of the order in which we live. Reading, of course, contributes immeasurably to the culture of the reader and indirectly to the culture of the community and society in which he lives.

How To Read

Within the last 20 years, the better teachers of reading have developed a great new field of literature on the art of reading. If you want to become a good reader, you can learn how by reading about it.

The mechanics of reading are best learned by taking a

How to Find Time To Read

1. You must create the desire to read.

2. You must adopt some simple techniques to help establish the reading habit.

The fact is that if you create the desire to do something, you will find time to do it.

If you spent 15 minutes a day reading it would mean, at the average reader speed of 300 words a minute: 126,000 words a month, or a million and half words a year, or roughly 20 books a year—four times the number read by library borrowers.

Make a time chart of your day. Find out what you do with your time. Most people don't know. You might find, by proper planning of your time that it is easy to fit in 15, 20, 25, or 30 minutes for reading. The secret of finding time is to use all of your time.

Read on the way to and from work. For many people this can mean as much as an hour a day. This would get you into the better-than-a-book-a-week class. The educational value of this would far exceed what the average person remembers from his college education.

Keep a good book in the bathroom. I have read in the bathroom for years.

Always carry a book with you or keep one handy. First, have one in your pocket. Second, have one in your brief case. Have a book in your travelling bag. Keep one by your bedside, keep one in your automobile.

course in speed reading. (CEI offers such a course).

While waiting to do these things, try these basic ideas: **1.** Concentrate as you read. **2.** Look for main ideas. **3.** Hurry. **4.** Disregard trivia. **5.** Concentrate. **6.** Don't move your lips. **7.** Hurry. **8.** Avoid regression, i.e. going back and rereading sentences. **9.** Concentrate. **10.** Read in as big word units as possible. **11.** Hurry. **12.** Concentrate.

How To Develop Reading Habit

Begin reading habit formation by starting with the things that interest you most: Good books on your hobby, good books on business, books pertaining to your responsibilities, the history of your home state, any place of nature that appeals to you, a place you spent your vacation, or something that would help you at your job.

After you develop an interest in any phase of reading books, do these things: Get a personal library card; browse a little in the library in the area of your interest. You will be amazed at the things you will find there that you want to read.

Reading the same time every day is a good habit developer; there is a time element in habit formation.

Buy some books. When you buy a book, you have a vested interest in it. You are a stockholder in the thing, and you are much more apt to read it.

Talk about what you are reading. That's one of the greatest ways to develop the habit of reading, and you will discover that people will want to listen to what you have to say about books you have read. Talking about books does three things for you:

1. It tends to fix their theme or ideas in your mind.

2. It helps develop your own interest in books because you will find that a lot of recognition attaches to knowledge of a good book.

3. It tests and sharpens your ability to analyze the opinion of others.

Set some reading goals. Twelve books a year would be fair, 24 would be good, 36 or more would be excellent.

Coupled with this is the development of a program—reading for a purpose.

The completion of a well-planned program will reward you with the satisfaction that comes from the creation of any value for yourself.

What To Read

Reading needs can be grouped generally this way:

Your specialty, our industry, business generally, management principles, general news, general educational information, analytical non-fiction, cultural-type of fiction.

Reading, of course, to fulfill a desire can be either reading to fulfill a need or can be pure entertainment. But even if it is just pure entertainment, it can have permanent value if the material is well selected.

Reading material also can be classified according to publication format:

1. Newspapers. Here is a place for speed reading.

2. Magazines. Magazines, in general, are a higher grade of writing than newspapers. A specialty magazine is a must. I cannot conceive of a good performer who relies on a specialty of any kind in his work not keeping up to date on it. A specialty magazine is an invaluable aid in keeping up to date; so it is a must.

Industry or trade magazines come pretty close to being "must" items.

Magazines covering business generally are also important. The Harvard Business Review Survey indicated that "the nearer to the top executives are, the broader their reading interests are," and consequently, virtually all of them read a business type of magazine.

For people who have management responsibilities, I think a management magazine also is a must.

It is not necessary to read every article in these magazines. The purpose of looking at them regularly is to make sure that when there is something of interest or of value to you, you will see it.

One hundred per cent of the executives in that Harvard survey subscribes to a general news magazine.

3. Miscellaneous Publications. There are a great variety of these some of which can be of value from time to time, such as the fine monthly economic letters put out by banks.

4. Books. Books present the finest of all reading opportunities. The greatest thinking of the finest minds, the finest expression of the greatest writers, and the most profound learning of best qualified experts in every field and every age are available in books. Books can be classified generally as non-fiction, fiction, poetry, and plays.

Non-fiction—If you classify non-fiction books according to subject matter, here is a broad base classification: 1. Biography, 2. Travel or adventure. 3. Fields of knowledge.

Obviously, it is in that third group, the fields of knowledge, that the truly fine material lies.

If you classify books as to purpose, they can have three purposes: **1.** Information. **2.** Entertainment. **3.** Understanding. So, the first step in selecting a book is to ask yourself where it falls in those classifications.

Perhaps the easiest way to find out what constitutes a good book is to go to a library. Librarians are specialists in identifying good books, and they love to work for you. The best seller list is a snare and a delusion.

- Don't hesitate to reread the very good books.
- Don't hesitate to read only part of a book if only part serves your purpose.
- Try to read the best books by whatever test you have to identify "the best books." There just isn't time to read all the books; so why waste time on the poor ones?

Fiction—Every well-read person reads some good fiction. The problem of selection is greater than in non-fiction because the available non-desirable fiction is greater. In good fiction we find some of our finest English composition and some of our most profound philosophy, coupled with rare entertainment features.

Poetry—The reading of poetry by businessmen not only has reached the vanishing point, but the decline has been accompanied by the development of an attitude that there is something peculiar about a businessman who reads poetry. This is a conclusion of the unlearned.

There are two great benefits from the reading of good poetry. One arises from the form of writing; the other from the quality of thinking. The selection of poetry to read is easy. Read the great poets. Everyone knows who they are. Modern poetry for the most part does not meet the standard of greatness.

Plays—Plays are character, human relations, and social studies. As such they tend to portray the problems of our times. Plays are easy to read, and they are entertaining.

INTEREST IN MEETINGS was stimulated with door prizes and dinners. Washer-dryer combination unit is awarded here

HEAT PUMP'S OPERATION is subject of many questions from onlookers who carefully examined exhibits after the talks

Electrical Living Road Show a Hit

SALES
Residential

American G&E and General Electric jointly sponsor exhibit aimed at telling building industry of electrical home needs

A traveling show, sponsored jointly by American Gas & Electric Co and General Electric Co, is selling electrical living throughout the operating areas of AG&E system companies. The show completed a tour of 15 cities at South Bend, Ind., on Aug. 31. Largest showing was at Ft. Wayne, Ind., where the turnout was 650. Average attendance elsewhere was 200.

Attendance at the shows was by invitation only. Architects, builders, electrical contractors, real estate men, FHA representatives, and mortgage lenders of the area were invited.

Designed to take the story of electrical living to the building industry, the show emphasized ample wiring, good lighting, heating, air conditioning, and electrical appliances. It told how the American people want these features and how more homes can be sold if electrical living is built into the home.

The show was introduced by local representatives of the utility company. Representatives of various GE divisions gave presentations for their products.

At the Ft. Wayne showing, T. F. Galvin of Appliance Park, Louisville, Ky., told the story of the certified kitchen design and the wall-type of refrigerator.

Y. M. Yurkanin, Construction Materials Division, gave the presentation on low-voltage, remote-control wiring, and on resistance heating.

G. T. Parsons of the Lamp Division presented the story on lighting and how good lighting can help sell homes.

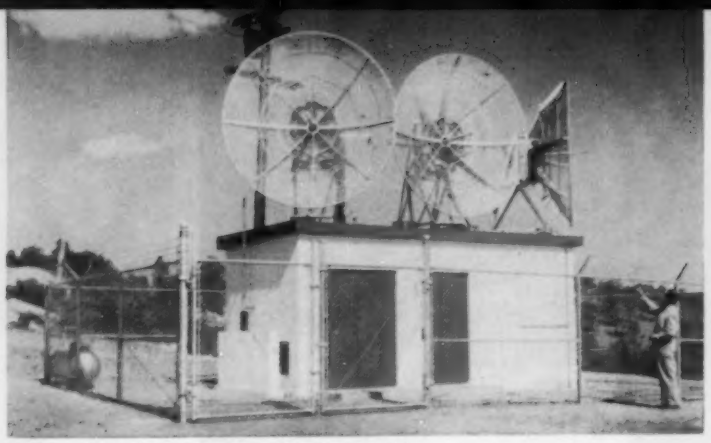
E. S. Douglass of GE's Weathertron Department explained the benefits of year-round comfort that is provided by the heat pump.

Presentations were backed up by color slides and equipment displays. The audiences showed considerable interest in the programs, and at the close of each meeting large groups came up to see the displays and ask questions about them. This evidence of interest continued until long after the close of the formal program.

The shows were usually preceded by a dinner, provided by the local utility company. A washer-dryer combination unit was given as a door prize.

Displays and props for the show were all fitted into one large trailer truck, driven by GE's H. A. Morphis.

Oceanside Office Sends . . .



Palomar Tee Repeater Picks Up . . .

Microwave Links Utility Offices

SYSTEM ENGINEERING
Communications

Outlying commercial departments now exchange information with San Diego headquarters over new communications network

P. H. ADAMS, Chief Load Supervisor, and **CECIL J. SCHNARR**, Communications Supervisor, San Diego Gas & Electric Co, San Diego, Calif.

Interchange of information between outlying commercial offices and main headquarters via microwave is being handled advantageously over the new system installed by San Diego Gas & Electric Co. This information, as well as executive communications, is transmitted by telephone and teletype. The initial microwave system also provides for gas telemetering, remote control of two VHF mobile radio stations, and extension of existing electric production interplant telephone.

Consideration of microwave was prompted by location of the 400-Mw ultimate capacity Encina Steam Station about 30 miles north of San Diego. Heretofore, communications between the dispatching center and generating plants, all in the city, were handled quite simply. Use of microwave was firmed up by the need for better communications with other key points north of the city.

First thoughts were given to providing telephone, telemetering, teletype, and supervisory circuits only as needed by electric system operation. However, the number of channels needed immediately suggested a look at what non-operational information could be handled on a microwave system.

To explore these possible uses, a company-wide survey was made of the use of communication facilities. By publicizing the possible uses of microwave channels, it was found that 50% occupancy of a 30-channel system could be developed in an initial installation.

An engineering consultant explored the economic advisability of the project and prepared these specifications. The microwave radio equipment and multiplex equipment use frequency-division modulation. The system provides 30 voice channels, each of which may be subdivided into 15 audio tones for relaying, telemetering, supervisory control, and other remote indicating and operating functions. There is a service channel for maintenance communication entirely separate from the 30 voice channels.

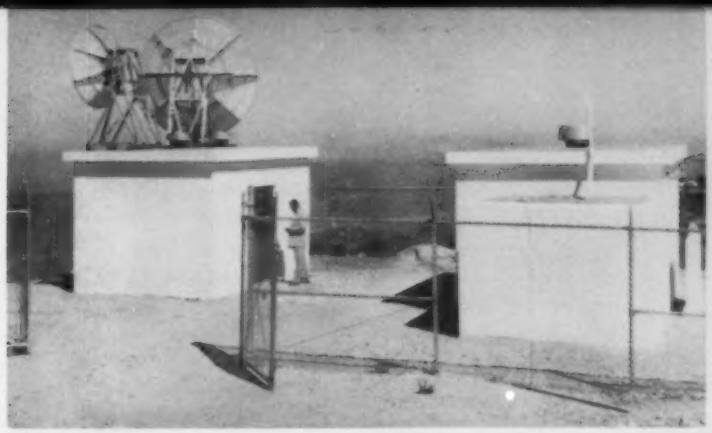
Commercial Use Important

Radio equipment consists basically of a transmitter-receiver, local oscillator-modulator, automatic frequency control and power supply. Through a transfer circuit, duplicate equipment for standby operation automatically switches on in the event of primary equipment failure. Duplication also permits routine maintenance of primary equipment without interruption of the system.

Handling of commercial information is among the most important non-operation uses of the microwave system. A five-pair cable connects the commercial office to the Escondido terminal. An existing building at Escondido substation, used by other departments, houses terminal equipment. Standby power is provided by an automatically-controlled, 5-kw, engine-generator set fueled by natural gas.

A novel application in this system provides for remote operation of a portion of the multiplexing equipment at the San Diego terminal. This multiplex equipment, in the main office building, is connected to the transmitting equipment by two continuous runs of RG-8/U coaxial cable about 4,300 ft long. These cables were run underground through 4-in. ducts without serious difficulty. San Diego terminal uses a 10-kw gas engine-generator set with automatic transfer for standby power. Natural gas is the fuel.

This system provides not only voice and teletype channels for business departments but also voice and control channels for operating departments. Two district commercial offices at Oceanside and Escondido in northern San Diego County connect via microwave to the commercial and executive automatic switchboard in the main office building. This provides a direct telephone link between various business departments and for transmission of daily reports, payroll data, etc, by teletype. Five voice channels provide this service for the business departments, and teletypes are connected as a part of the party-line teletype channel. One voice channel will be used as a conference circuit.



Otay Repeater Is Another Link . . .

San Diego Receives

One unique part of this multiplex system is three independent automatic dial switchboards used by separate departments. One for commercial and executive's automatic dial system serves business departments. A second, the operating department dial system, serves the electric transmission and distribution departments and the gas department. Finally, the electric production dial system ties the company's three generation plants together.

Installation of three terminal stations and two repeater stations in the initial microwave system provides for 15 voice channels, four telemetering channels, a party-line teletype channel, and two VHF control channels. For future expansion, all buildings were constructed large enough to accommodate additional equipment.

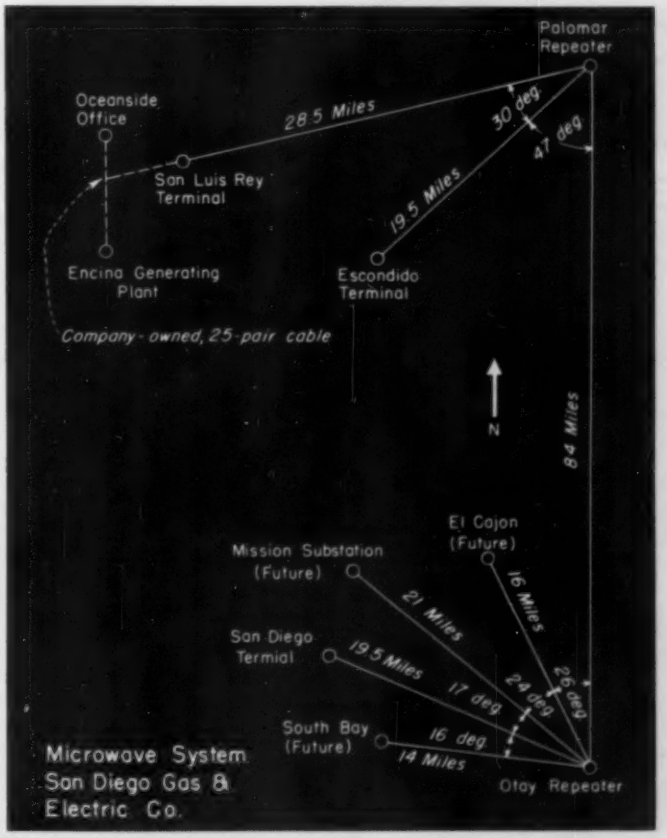
Diesels Provide Power

Otay repeater station presented problems because of its remote and desolate location. Following a cost comparison of stringing lines or providing diesel-powered generators, it was decided to install two 10-kw diesel-generators, one for primary power and one for standby. Controlled by a preset timer, these generators can alternate from primary to standby for from one to seven days. The standby generator starts automatically should the primary generator fail.

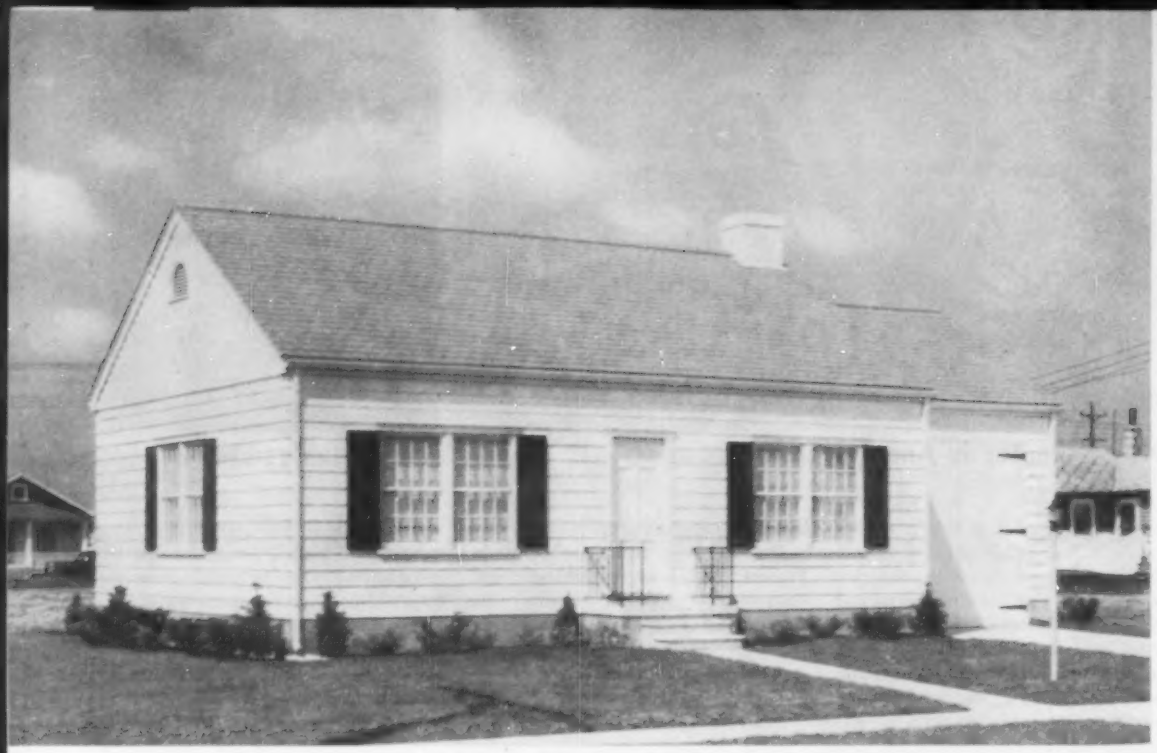
Palomar repeater station, designed as a "Tee" repeater, connects the microwave link going to Escondido terminal and operates as a repeater in the Otay-San Luis Rey link. This station has a 5-kw standby gas engine-generator and an automatic transfer panel to start operation should the commercial power fail. Propane fuel is stored in a 150-gal tank. The engine-generator consumes an estimated 2 gal of fuel per hour.

Because of weather conditions on Palomar Mountain the antennas and towers were designed to meet the stress of a 100-mph wind with a 1-in. ice load. A lightning rod has been installed because of severe storm conditions in the area.

San Luis Ray terminal, housed in a steel building, is provided with standby power identical to the Palomar installation. This terminal connects by a 25-pair, company-owned cable to Encina Station and Oceanside Plant and commercial offices. It also is the microwave system tie to the Southern California Edison Co Chino carrier telephone.



MICROWAVE PATHS link commercial offices of San Diego Gas & Electric Co and also the system dispatcher with Encina Plant for sending, receiving



'Cottage' Substation Wins Approval

SUBSTATIONS
Design

Meets area esthetic standards where Atlantic City Electric Co brings in new facilities to supply growing residential load

R. M. WILSON, Substation Superintendent, Atlantic City Electric Co, Atlantic City, N. J.

"Cottage-type" substations today are meeting the requirements of planning boards, zoning ordinances, and property owners generally. In providing necessary facilities for growing residential load, Atlantic City Electric Co installs such substations. By complying with local esthetic requirements, the company overcomes objections and is able to locate equipment properly with a view to its electrical function and economy.

The company has developed a substation design in which all station equipment is contained in a residential-type, one-story structure. From the outside, the structure looks like a home which, in that area, would be in the $15,000 to $18,000 class. This building, or "bungalow" as it is called, accommodates two incoming 23 or 34.5-kv circuits, two 5,000-kva, 3-phase transformers, and four outgoing 4,330-v feeders. All circuits enter the building through underground cables. Connections between transformers and switchgear are made with underground cable using cable terminal compartments on the transformers.

Noise Also Objectionable

High-voltage circuits are switched with load-break switches, and metal-clad switchgear is used on the low-voltage circuits. Switchgear and buses are under the building's roof, and low-voltage switchgear in the "garage." Besides balancing the appearance of the structure, the garage doors open wide enough for the installation and removal of equipment.

Transformers are in what is called a "wing-wall" section in the rear of the main body of the building. This section is open at the top, having only a simulated roof at the sides, and the rear is enclosed by a wire mesh fence covered with suitable planting. The rear section was designed to facilitate installation and removal of transformers.

The design calls for concrete block construction, a special beveled block known as "shadow block" being used on the exterior. Shadow block, properly laid and painted, gives the appearance of cedar shingles. The main body of the building including the garage contains 1,015 sq-ft. A truss-type roof will provide a minimum of 12½-ft head room. The transformer enclosure will contain 512 sq ft. Lawn and shrubbery will landscape the remainder of the property.

Our expanding economy and increased standard of living today probably account for the restrictions placed on structures in new residential developments. Residents place considerable emphasis on structural appearance, landscaping, and general layout. They also object to transformer noise.

When noise-level tests indicated that this first substation design was not entirely satisfactory, the company modi-

fied the design to include a masonry wall with removable panels. This wall will completely enclose the transformer section. The simulated roof will be replaced by a railing similar to the sundecks quite common in the area.

Cost Is About $18,000

Noise-level tests show that the masonry wing wall is quite effective in reducing transformer noise in the area of the substation. At one site, equipped with a single 2,500-kva transformer, the level was lowered from 64 db inside the enclosure to 43.5 db at a point 15 ft outside the walls. The level was 51 db.

The level on the front steps of the building was only 41 db, which was about the ambient. Directly behind the substation, as far as 200 ft away, the level was 52 db. This level indicated the desirability of completely enclosing the transformer with masonry walls.

To give the "bungalow" substation a "lived-in" appearance, time clock controlled lights are placed in the windows. These are turned on at dusk and off at 11 PM.

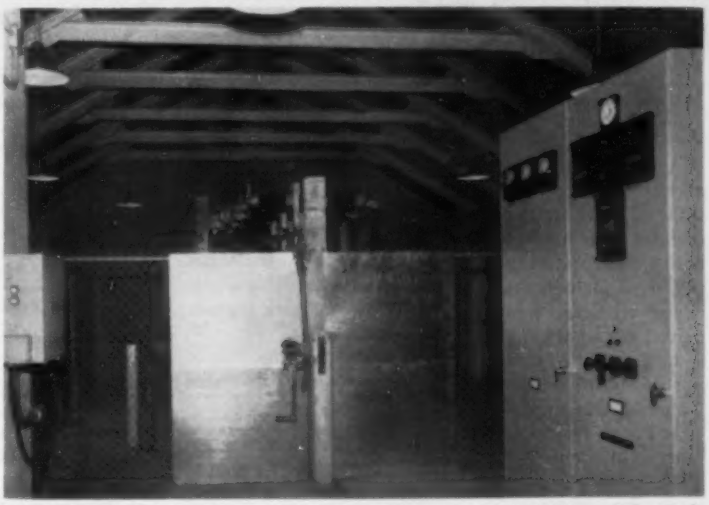
Building costs, including grading, sidewalks, curbs, and cable duct, amount to about $18,000. This cost compares favorably with the outdoor metal-clad design sometimes used in areas less restrictive about building practices. When the maximum number of circuits is involved, the cost of the "bungalow" design is substantially less.

Design Still Experimental

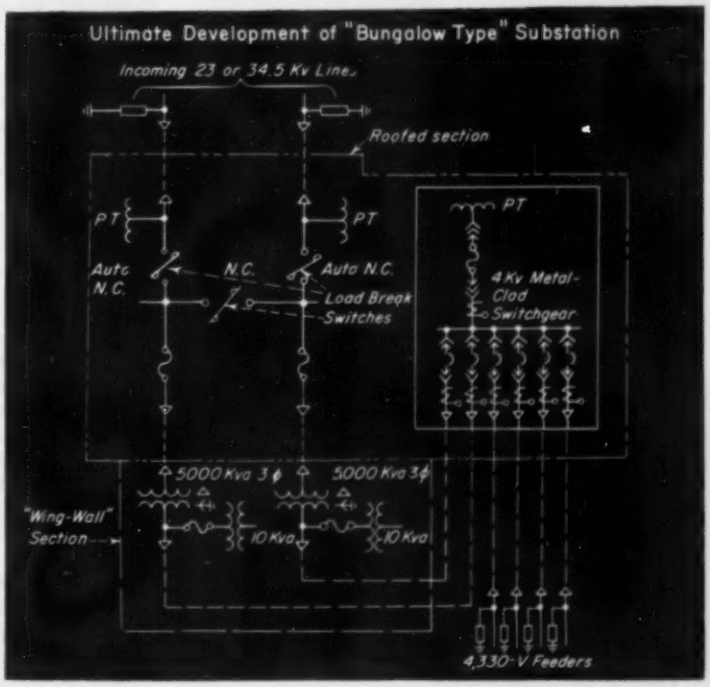
Atlantic City Electric made its first approach to the problem of neighborhood sense of propriety by using metal-clad switchgear equipment or unit substations screened with attractive landscaping. A masonry wall was used when noise-level reduction was required. Although this approach was a decided improvement over conventional substation structural design, the company encountered locations where only residential-type structures were permitted.

With its "bungalow" substation, the company has experienced little difficulty in obtaining the acceptance of local zoning boards. In company planning, however, it remains merely one approach to the substation appearance problem and is still considered by the company's planners as an experiment.

REAR VIEW of "bungalow" type substation shows "wing-wall" section for transformer. The chain-link fence will be screened ultimately with shrub plantings



INSIDE VIEW of "bungalow" type substation shows metal-clad 4-kv switchgear in right foreground and the 23-kv switchgear behind the barrier in the background



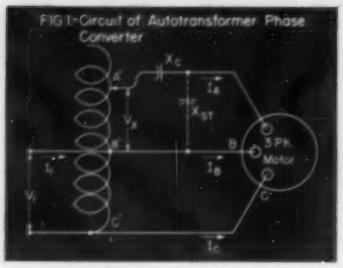


FIG 1-Circuit of Autotransformer Phase Converter

DISTRIBUTION
Operation

Autotransformer Betters Motor Phase Conversion

Circuit of new static unit provides 3-phase currents to 3-phase induction motor from a single-phase line and also has a low starting kva requirement

JOSEPH C. HOGAN, Associate Professor, College of Engineering, Department of Electrical Engineering, University of Missouri, Columbia, Mo.

A new type of phase converter for stepping up voltage of one line employs an autotransformer in conjunction with the usual series capacitor. Its use permits relaxation of many limitations on the application of the capacitor-only phase converter, over which it has these advantages:

1. It is the only static phase converter available whose circuit provides balanced 3-phase currents to a 3-phase induction motor from a single-phase line.

2. The starting kva it requires is much less than that of a single-phase motor or a 3-phase motor on balanced 3-phase power.

3. Power factor is improved throughout the operating range of the motor.

4. Starting torque compares favorably with that of a single-phase motor.

5. Starting kva per ft-lb is less than that of the single-phase or 3-phase motor.

6. Cost of autotransformer phase converter and 3-phase motor is competitive with that of a single-phase motor.

7. Simplicity of the 3-phase motor reduces maintenance.

8. Where 3-phase power may eventually become available, it permits immediate use of 3-phase motors.

9. Converter units of a given horse-power rating may be used with motors smaller than that rating.

A 3-phase motor operates ideally when balanced 3-phase voltages applied to the motor terminals result in balanced line currents. Theoretically this balance prevails for phase converter-operated induction motors when the following equation is satisfied:

$$Z_m/\theta_m(N/0^\circ + 1/-60^\circ) = \frac{X_c}{\sqrt{3}}/0^\circ \ldots \quad (1)$$

where:

Z_m = impedance per phase of the induction motor.
θ_m = power factor angle of the induction motor.
$N = \left|\frac{V_a}{V_{BC}}\right|$ as given by tap setting on the autotransformer.
X_c = reactance of capacitors in series with line A (Fig 1).

As both autotransformer tap setting N and capacitive reactance X_c may be varied, the above equation can be satisfied for any polyphase induction motor, thus assuring balanced operation at a particular load. As load requirements change, the motor no longer has exactly balanced currents. Accordingly, the values of N and X_c must be adjusted initially to give balanced operation for the load condition normally encountered.

The theory of other types of phase converters may be treated as a special case of the autotransformer phase converter. Adjusting the tap setting A′ to point B′ makes V_a equal to zero. The autotransformer then has no effect on the operation of the phase converter, and the circuit is identical with that in the capacitor-only phase converter. When N equals zero, equation (1) becomes

$$Z_m/\theta_m - 60^\circ = \frac{X_c}{\sqrt{3}}/0^\circ \ldots \quad (2)$$

This equation can only be satisfied when

$$\theta_m = 60^\circ$$
$$X_c = \sqrt{3}\,Z_m \ldots \quad (3)$$

From equation (3) it is seen that only the special case of power factor equal to 0.5 can be balanced. Usually this occurs only when the machine is very lightly loaded. Consequently the autotransformer is essential in phase converters to obtain the desired balanced operation for a motor operating under load.

Table I gives operating characteristics of the autotransformer phase converter derived from tests with a 3-phase, 220-v, 60-cps induction motor rated at 3 hp at 1,165 rpm. Load runs were made with the motor connected directly to a 3-phase line and again to a single-phase line through the phase converter. Separate runs were made for the phase converter adjusted to give balanced conditions.

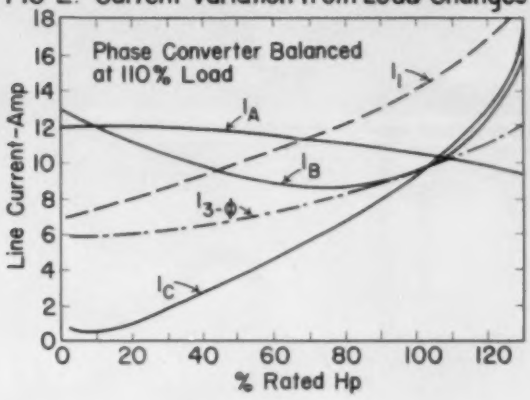
Results of two runs with the phase converter set to give a balance at 70 and 110% of rated output are shown in Fig 2, where variation in line current is plotted as a func-

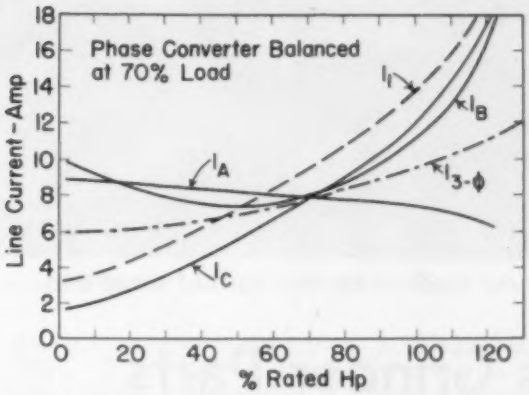
Table I–Operating Comparison, 3 H.P. Induction Motors

	3 Ø Motor on 3 Ø	3 Ø Motor, Autotran. Ph. Converter		Single ** Phase Motor
		70% Balance	110% Balance	
Line Volts	220	220	220	230
Breakdown Torque (% Rated Torque) *	250%	138%	145%	200%
Starting Current (Amps)	48	53	58	70
Starting Torque (% Rated Torque) *	210%	155%	195%	175%
Starting kva	18.3	11.7	12.8	16.1
Starting kva/ft-lb	645	57	49	68

* Rated Torque = 13.5 ft.-lbs.
** Capacitor Start–Capacitor Run

FIG 2.-Current Variation from Load Changes





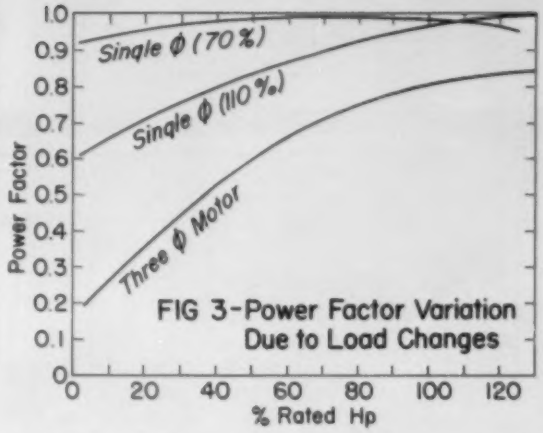


FIG 3-Power Factor Variation Due to Load Changes

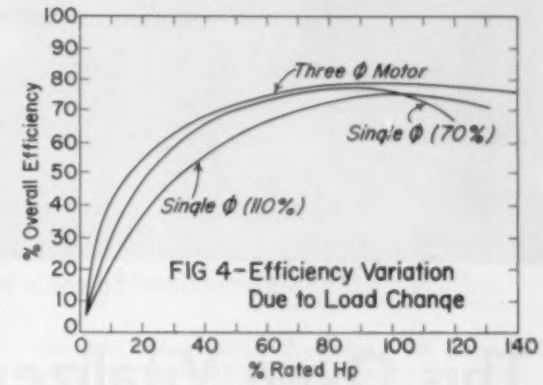


FIG 4-Efficiency Variation Due to Load Change

tion of horsepower output. The curves show that line currents can be balanced at particular load values, although current unbalance varies considerably as load increases or decreases from the point of balance.

Voltage variation because of line drop is a serious problem on rural single-phase lines. As voltage drop is proportional to line current, it is desirable to keep line current for a given power at a minimum. In other words the power factor should be as close to unity as possible. The excellent single-phase power factor characteristics of the autotransformer phase converter are compared in Fig 3 with the power factor of the 3-phase motor.

In matching a motor to a given load, torque variation as a function of speed is the most important factor. A motor operated through the phase converter has a speed-torque characteristic very similar to that of a motor operated directly on 3-phase up to loads of about 120% of rated horsepower. For loads in excess of this value speed drops very rapidly, and the breakdown torque is much lower than for 3-phase connection. For certain types of load occasionally requiring excessive torques, it may be necessary to use the next larger size motor.

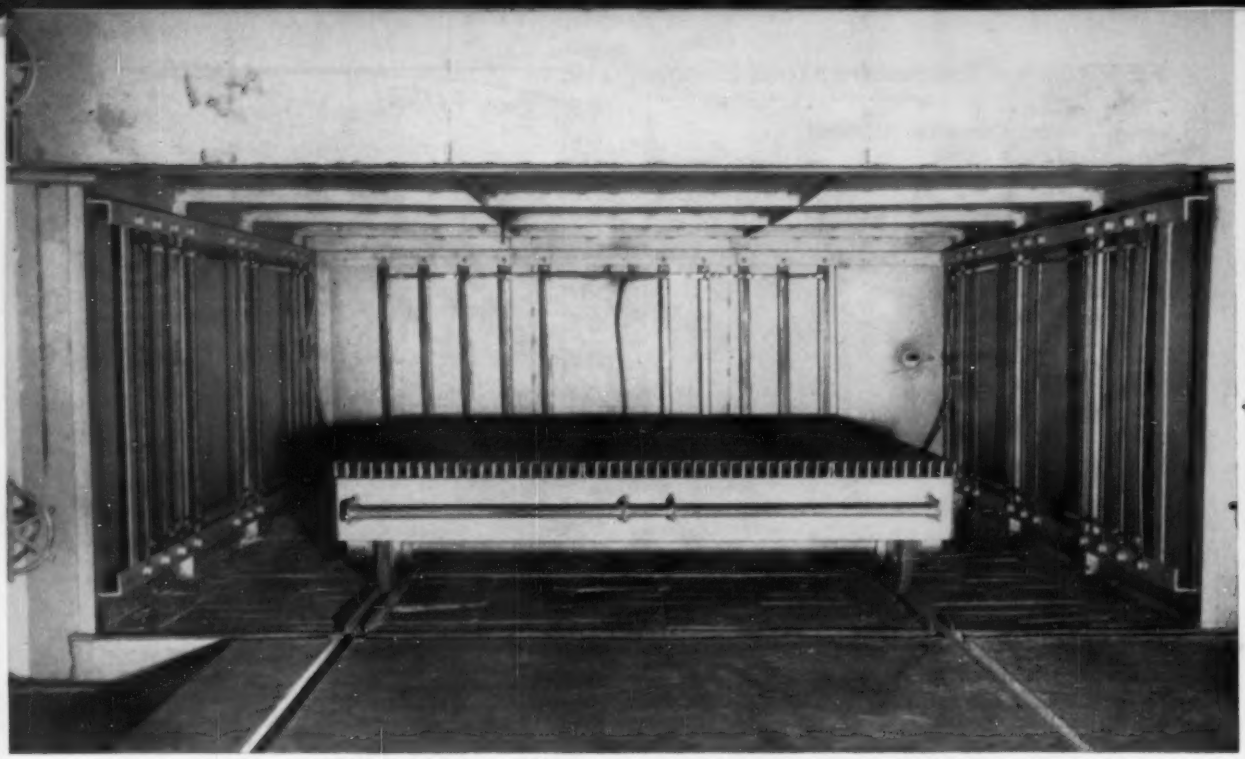
The overall efficiency on single-phase using the phase converter is almost the same as the motor efficiency on balanced 3-phase. The only losses in the phase converter are core and copper losses of the autotransformer. Additional losses, however, occur in the motor for unbalanced operation because of negative sequence losses. This results in overall efficiencies approximately equal to the efficiency on 3-phase at points of balance. As unbalance increases, the overall efficiency decreases because of the additional motor losses, as shown in Fig 4.

For starting an additional capacitor X_{ST} is required in the circuit to provide the required starting torque. This capacitor tends to balance currents at starting and is disconnected by means of a relay circuit sensitive to voltage V_{AB} after the motor comes up to speed. Characteristics at starting (locked rotor) are given in Table I. Characteristics of 3-hp, single-phase, general-purpose induction motors, as taken from recommended values in NEMA Standards, are also given for comparison.

The autotransformer phase converter thus has the lowest, ie, most desirable, value of kva per ft-lb at starting, and the autotransformer is just as essential to the circuit at starting as it is during running conditions. Recent tests on capacitor-only phase converters indicated a starting kva per lb-ft of 0.86, compared with 0.57 for the autotransformer phase converter balanced at 70% rated load.

The autotransformer phase converter-3-phase induction motor combination can be used as a source of power where only single-phase is available without the usual excessive voltage drop during starting. For loads requiring almost constant power the unit can be adjusted to give balanced operation at a high power factor for the particular load.

The autotransformer phase converter has two disadvantages. Although comparable to that of a single-phase motor, its breakdown torque is less than that of the 3-phase induction motor on balanced 3-phase power. Also, its starting torque is about 85% of that of the 3-phase motor and about that of a single-phase induction motor.



Metropolitan Edison's home-made oven was built of scrap and . . .

This Oven Vitalizes Grinder Parts

INDUSTRIAL Construction

Built almost entirely of scrap by Metropolitan Edison Co's own plant employees, it prepares worn parts for life-extending welds

JOHN F. WITMAN, Superintendent, Titus Station, and
JOHN L. BACHOFER, JR., Engineer, Metropolitan Edison Co, Reading, Pa.

A home-made electric oven is helping the Metropolitan Edison Co extend the life of coal pulverizer parts at its Titus Station, Reading, Pa.

Built almost entirely of scrap by power plant employees, the oven preheats worn parts from the pulverizers so they can be "hard faced" by an electric welding process. After this is done, the oven cools the parts gradually to prevent cracking.

It was found that the life of the pulverizer rollers and grinding ring—which formerly wore out about every 12 months—could be extended as much as three times by hard facing. Using this process, workmen apply layers of hard metal to worn surfaces. Results include increased plant efficiency and reduced maintenance time, frequency adjustments, and new-part expenses.

Early attempts at hard facing with hand-held welding equipment proved unsuccessful. The metal neither could be applied evenly nor fast enough. The preheated workpieces cooled rapidly and had to be reheated often before the job was finished. Finally a satisfactory automatic welding machine was developed.

After deciding that the automatic equipment was economical, the utility was faced with the problem of preheating these parts before the welding operation was started.

Why an *Electric* Oven Was Chosen

The electric oven was chosen for these reasons:

- It would be safer than a flame-type oven would have been. Some types of the latter would have presented a fire hazard and would have required storage space for fuel bottles.
- It could be made completely automatic through electric controls.
- It would always produce an even preheat to the desired temperature.

Construction Details

The oven was designed and its construction supervised by the authors. For simplicity and lowest cost, standard structural steel shapes and all-welded construction were used throughout. The oven has independent inner and outer roofs and wall casing of ⅛-in. sheet supported by 3-in. channels. Each casing is set on a 3½ x 4½-in. double-angle iron frame.

Thermal insulation between casings consists of 2 in. of 85% magnesia block and 7 in. of loose vermiculite. The vermiculite allows independent expansion and contrac-

. . . preheats coal pulverizer parts . . .

. . . for "hard-facing" welding process

tion without distortion of either casing. The insulation was designed to afford an outer surface temperature low enough to avoid burning personnel who might accidentally contact it.

The casings are restrained at a minimum number of points, and no buckling is evident to date. The oven floor consists of firebrick laid over 6 in. of refractory cement. A counterweighted door, insulated with glass wool to keep its weight to a minimum, completes the enclosure. This door is held tightly closed by four dogs, which, when released, allow the door to move away from the oven slightly before being lifted, thus avoiding any tendency to bind. Safety latches are engaged in the full open position of the door. They positively prevent accidental closure of the door.

No vents are necessary, nor are any provided, as the oven can "breathe" through spaces between the intermittent welds in the casing joints. Circulating fans are not used. Provision was made for insertion of test thermocouples.

Easily Loaded by One Man

Work is placed in the oven on a cart which runs on a short channel iron track extending from inside the oven to an electric monorail hoist on the outside. The cart was built of channel iron and standard floor grating, to allow thorough "soaking" of the work pieces in the oven. Even when loaded, it is easily moved into or out of the oven by one man.

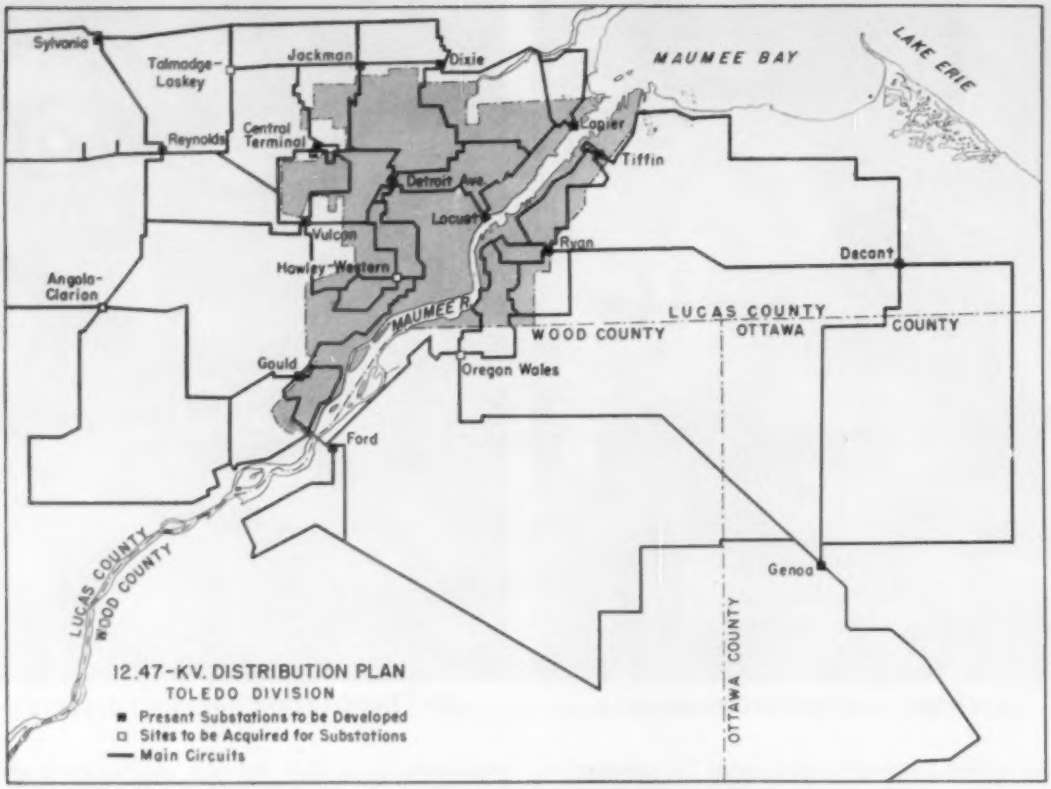
The oven is heated by 36 high-temperature, chrome-sheathed strip heaters, comprising a total load of 36 kw. Power suply is 208 v, 3 phase. Oven temperature is sensed by a helical bimetallic element which operates a mercoid switch. Temperature setpoint is adjustable throughout a range from 150 to 500F, and experience has shown that this off-on control will maintain temperatures satisfactorily at the desired value. An adjustable controller was necessary because different workpieces require different preheat temperature. Should the thermostatic switch fail and allow continuous operation of the heaters, tests have shown that with the number of heaters now installed, 550F is the maximum temperature attainable with the work load in the oven.

How Oven Is Programmed

A time clock installed in the circuit permits programming the oven. Normally, a workpiece is placed in the oven just before quitting time at the end of the day, and the time clock set to switch on the oven during the early hours of the following morning so that the piece is fully preheated when the welding operator reports for work. The oven reaches temperature in about 2 hr with a half-ton piece to be preheated to 450F. Additional soaking time is allowed at the rate of 1 hr per inch thickness. After hard facing, work is returned to the hot oven for slow cooling to room temperature.

Conductors inside the oven are Monel ribbon $\frac{7}{8}$ in. wide by 0.032 in. thick. Monel was chosen instead of aluminum or copper for this particular service because its relatively low thermal coefficient of expansion prevents its working loose at joints because of alternate heating and cooling. The ribbon is glass-taped where it is led out through asbestos rope-packed conduits to junction boxes.

Experience with the oven during the first six months of operation has shown that it performs quite satisfactorily, permitting hard facing to proceed with a minimum of delay, a maximum of efficiency, and with excellent results.



Extensive Distribution Expansion Program Forces Toledo Edison to . . .

Solve 12-Kv Conversion Problems

DISTRIBUTION
Operation

- **By analyzing advantages, disadvantages of proposed plans**
- **By developing program and applying it to correct limitations**

CHARLES E. FLAHIE, Transmission and Distribution Engineer, Toledo Edison Co., Toledo, Ohio

Where is distribution going? When Toledo Edison Co's management started asking such questions, they initiated studies that led to the present program of conversion to 12.47 kv.

Object of these studies was to determine what would be needed in the way of a distribution system to serve the loads of the future. All signs pointed to 12 kv. Its advantages include:

1. 12 kv carries more load farther, a desirable characteristic with today's rapidly growing loads.

2. More positive relay action is obtained with 12 kv.

3. 12 kv gives improved appearance with fewer circuits on a pole line.

4. It's wider spacing requires fewer poles.

5. With wider spacing and only one circuit per pole line, sleet hazards will be reduced.

6. 12 kv has been used successfully for rural distribution. Designs were fully developed and economics appeared sound.

7. Consulting engineers with firing-line experience favored 12 kv.

8. Voltages have gone up through the years. If it could be assumed that load growth would continue at no less than the historical rate, higher primary voltage was inevitable.

All of the disadvantages cited against 12 kv appeared to come from those with no experience. Disadvantages considered included:

1. The company was deeply committed to 4 kv.

2. Load per feeder at 12 kv is too high.

3. Tree trimming is a bigger problem with 12 kv.

4. There are more hazards at 12 kv.

Those with experience seemed to believe that these disadvantages are not so serious or as objectionable in actual experience as they seemed to be in preliminary considerations. Objections were analyzed carefully and preventive measures taken as far as possible to minimize the problems of changing to 12 kv.

The objection, "deeply committed to 4 kv," yielded to the reasoning that the longer conversion is deferred, the deeper will be the commitment. It was reasoned that changeover could be a gradual replacement of worn-out equipment with equipment of 12-kv design.

Opinions as to maximum desirable feeder capacity ranged from 300 to 15,000 kva. Experience indicated that high-capacity feeders could be designed as reliable per unit as existing feeders.

Avoid Trees for Reliability

Tree growth affects 12 kv more than 4 kv, but most operating troubles come from short poles, deferred trimming, and breaking of overhanging branches. Plans were developed so that unfused sections of a feeder are not routed under trees. If necessary the circuit is placed underground. Branch circuits are fused if demand is under 650 kva 3-phase or 270 kva single-phase. Reliability of the feeder-main trunk is preserved at all cost.

Companies with experience reported no detectable rise in accident rate after going to 12-kv. Some said that hot line tools were safer than gloves. Although hot-tool work is expensive, "rubbering up" sometimes costs an appreciable amount too. One heartening report was that linemen prefer hot sticks.

Since the decision was reached to convert to 12 kv, all efforts have been directed to that end. The policy set has been firmly kept. There has been no temporizing. There have been many "proofs" that using lower voltage in this or that circumstance would save money. But on the philosophy that ultimate values are greater than the immediate, we have kept strictly to the plan of converting to 12 kv. We believe that foresight now in getting ready for tomorrow's load will improve the system and reduce costs.

Every item of equipment and material that is purchased and every man-hour of labor prepare the system in some way for operation at 12 kv.

Customer equipment is bought and installed for eventual operation at 12 kv. Customers have been generally agreeable to this program of planning for the future.

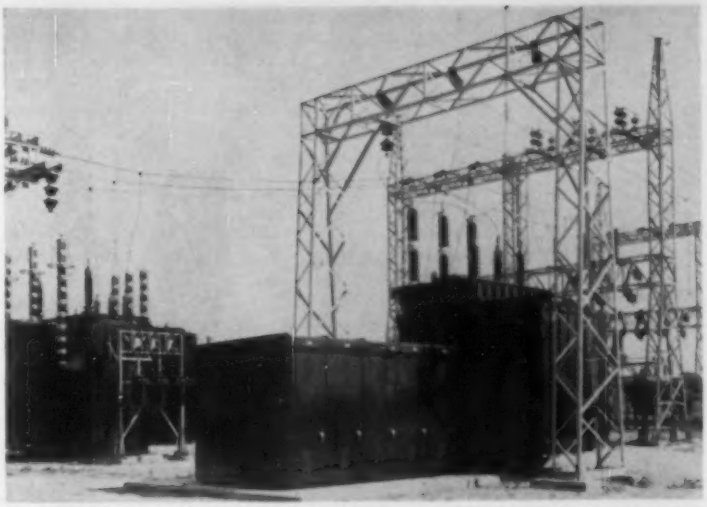
Principles Guide Conversion

When the decision to convert to 12 kv was reached, a set of principles was developed:

1. Capacity of all components of the system from generator to customer would be forced upward.

2. Existing substations would be worked more intensively at 12 kv. They could serve more than twice as much load at the higher voltage.

3. Conversion to 12 kv would pro-



SUBSTATION CAPACITY IS BOLSTERED with new 10,000-kva unit stepping down from 69 kv to pick up at 12.47-kv load being converted from the 4-kv system

12.47-KV FEEDER is overbuilt on poles carrying the 4-kv local distribution

SINGLE-PHASE LATERALS take off in vertical configuration from 12.47 kv

RIDGE-PIN CONSTRUCTION of laterals makes neat appearance on joint poles

TRANSFORMER INSTALLATION places cutout and arrester on a crossarm

ceed simultaneously over the system as problems arose, with no area reserved for any reason.

4. Bus regulation would be provided.

5. System design would provide for not more than one 12-kv circuit per pole line.

6. The number of circuits from a substation would be limited by exit routes for one-circuit pole lines. As many as seven seemed possible under the most favorable conditions.

The transition to 12 kv required planning. We wanted to push out 12 kv from a limited number of substations while pulling lower voltage feeders back closer to their buses. Completely new substations were to be avoided. All equipment and material, except pins and insulators, were to serve out their natural life in place if possible. Finally, actual operation at 12 kv was to be triggered by a regulation problem, a substation capacity problem, or a natural rebuild. No step is taken simply for the sake of conversion, but no opportunity is missed to prepare even one pole for it.

Problem Triggers Change

If the problem which prompts conversion is one of regulation midway between substations, the new feeder usually is run directly to the problem area by converting one line, or one wedge, or one feeder, depending on the case. If it is a thermal problem on the feeder or capacity at the substation, the initial 12-kv move will grab quantity loads as close to the substation as possible. Ingenuity finds many ways to take problems, and problems only, on 12 kv.

A completely new set of structure standards was developed. The impulse level was raised materially with greater spacing and more wood. Every new pole and every existing pole that is replaced is built to the 12-kv standard regardless of the operating voltage of distribution on it. Distribution poles are being replaced constantly for new driveways and street lights, after accidents, storms and early failures, or as natural rebuild, so the process of preparing the system for conversion goes on steadily.

Where there is more than one 4-kv circuit on a pole line, each serving a different area, the upper circuit is sometimes cut to 12-kv to serve the more remote area while the lower circuit is retained intact. The principle of one 12-kv circuit per pole line is followed, but 4-kv circuits remain in place during the wear-out process.

Where system design can be improved by finding new routes for 12-kv circuits, this is done although there may be a pole line available with more than one 4-kv circuit.

Main Feeders Are Heavy

Main trunk feeders are made large and strong. They are not fused. All other primary circuits are fused. Maintenance, rebuilding, or tree trimming may be deferred on fused branches but never on main trunk feeders. The 12-kv trunk feeders have been laid out for much of the system, and these layouts are being followed.

Feeders are rated 7,500 kva for urban densities and 2,500 kva for rural areas. An urban feeder is 336,400 circ mil aluminum from the substation until some load is subtracted. Then they are No. 4/0 aluminum to the open tie switch which separates the feeder from a similar feeder out of an adjacent substation. The main trunk feeder of a 2,500 kva rural feeder is No. 1/0 ACSR throughout.

Ideally, 12 kv is an area blanketing facility and a quick conclusion may be that substations would be eliminated. Actually the conversion process leads to addition of 12-kv to existing substations before they wear out.

The first 12-kv buses at substations were carefully located. They were planned at alternate existing substations so the load growth of two areas could be taken on each new bus. In this way they can pick up maximum load.

Transmission reliability is also considered in locating 12-kv buses. Such things as the number of incoming lines, breaker arrangement, and other factors affecting transmission reliability are weighed.

Field Ties Provided

Plans called for field ties between the 12-kv substation buses early in the program. Substation locations were chosen to facilitate them. Completely new substations were located on existing transmission lines with excess capacity.

Initial substation transformer sizes were selected on the basis of area load growth and 12-kv reach. Sizes purchased were 2,500, 5,000, and 10,000 kva. There is a possibility that larger units will come into the picture later. Each transformer is to be loaded to its self-cooled rating, with the fan rating used for emergency only. Initially, one transformer is installed at each station, with reliance on a mobile substation and field ties for emergencies until the other unit is required.

When a substation is completely converted to 12 kv, which may happen soon to small substations, the released transformer may be used at any lower voltage substation which has only a capacity problem.

Works Plant Harder

Key to the economics is conversion to 12 kv versus retention of lower voltage with subtransmission extensions, more substations, and shorter feeders. Studies of hypothetical systems at urban densities have not of themselves settled the question. For us, the ability to work existing subtransmission and substations more intensively was decisive.

Other advantages hard to evaluate are the convenience of operating and maintaining larger substations rather than numerous small ones; avoiding the exposure of an extended subtransmission system; the ability to start 12 kv at some transmission stations avoiding use of subtransmission; and, in some cases, avoiding additional transmission stepdowns.

Insulators, cable, arresters, cutouts, and transformers cost more for 12 kv than for 4 kv. Wire losses are somewhat less. The comparison is better for a 7,500-kva feeder than for an 1,800 kva feeder, on a kva basis.

Comparison of prices for 2,400 and 7,200-v distribution transformers reflects the manufacture of 2,400-v units in larger sizes. The 7,200-v transformers have been bought chiefly in small sizes for rural service. Extensive conversion of distribution systems to the higher primary voltage may change that. Higher secondary voltages also favor 12-kv because they will mean larger transformers.

Control of distribution transformer stock can make or break the whole program. The rate of conversion to 12 kv should equal the load growth in kva plus the junking of transformers in kva.

Stepdown auto-transformers in two sizes, 50 and 167 kva, are used as construction tools. The same transformers can be left on lines as stepups or stepdowns to postpone conversion when that is desired. This is a quick and easy way to solve some problems, but the goal is 12-kv conversion, not more transformations.

Since 1952:

Busbar Energy Costs Are Unchanged

Station Costs Are Down

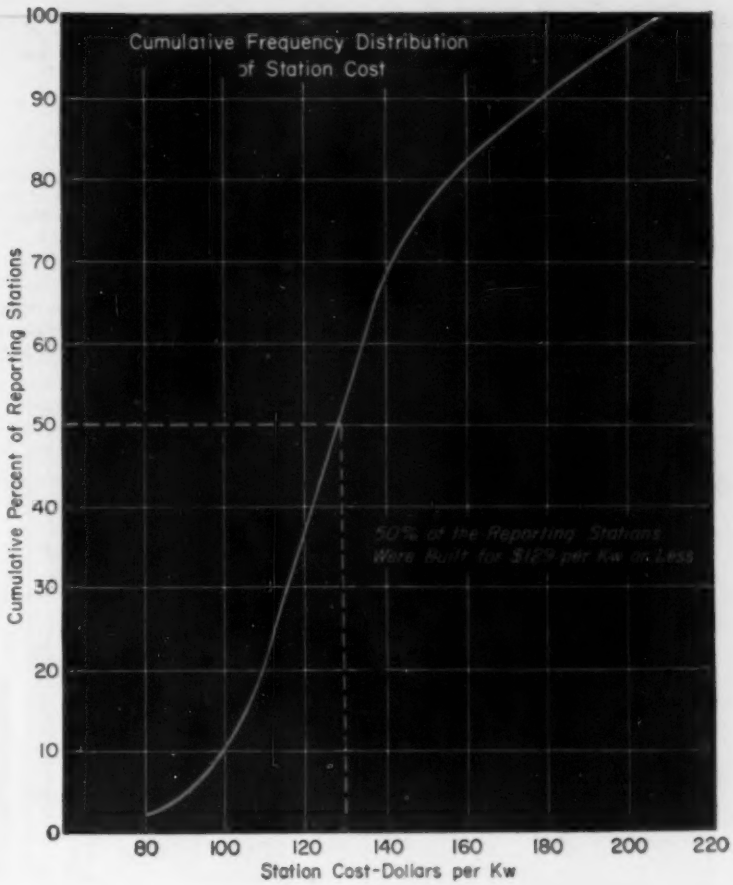
Production Costs Are Less

Efficiency Continues to Improve

Manpower Needs Lowered Sharply

Outdoor Plants Grow in Popularity

These Are Significant Conclusions From Study of 54 Plants Covered in . . .



9th Steam Station Cost Survey

JOHN J. KEARNEY, Associate Editor, Electrical World

What does it cost to build and operate a modern steam power plant? How do these figures for today compare with those of preceding years? With 1952? With 1950?

Electrical World's Ninth Steam Station Cost Survey of 54 modern steam power plants holds the answers to these questions. Authenticity of this statement is assured by the sheer magnitude of the capacity reported. Capability of the reporting plants totalled about 11,850,000 kw. In 1954 these plants generated 78 billion kwhr and in so doing burned about 22 million tons of coal, 10 million bbl of oil, and 181 billion cu ft of gas. It cost about $1.5 billion to design and construct these plants.

Highlights of the survey results are as follows:

1. Total cost of energy (fixed charges plus operating expenses) averaged about 6 or 7 mills per kwhr. About the same as in 1952.

2. Average cost of building a plant (excluding switchyard facilities) was $131 per kw. Range of costs was $100 to $170 with extremes of $75 and $222. Average cost was less than in 1952.

3. Small outdoor plants cost $75 per kw less than small indoor plants—for larger plants difference was $17.

4. Cost advantage of oil and gas fired plants over coal fired plants decreases as size increases.

5. Plant investment is largest in the boiler account amounting to 37-40% depending on type of fuel used.

6. Fuel constitutes about 83% of the production cost.

7. Average cost of production was 3.1 mills per net kwhr. Down slightly from the 1952 figure.

8. Maintenance costs also lower than 1952 average.

9. Largest maintenance item is still boiler account.

10. Majority of stations had heat rates of 12,000 Btu per net kwhr, with some under 10,000 Btu per net kwhr.

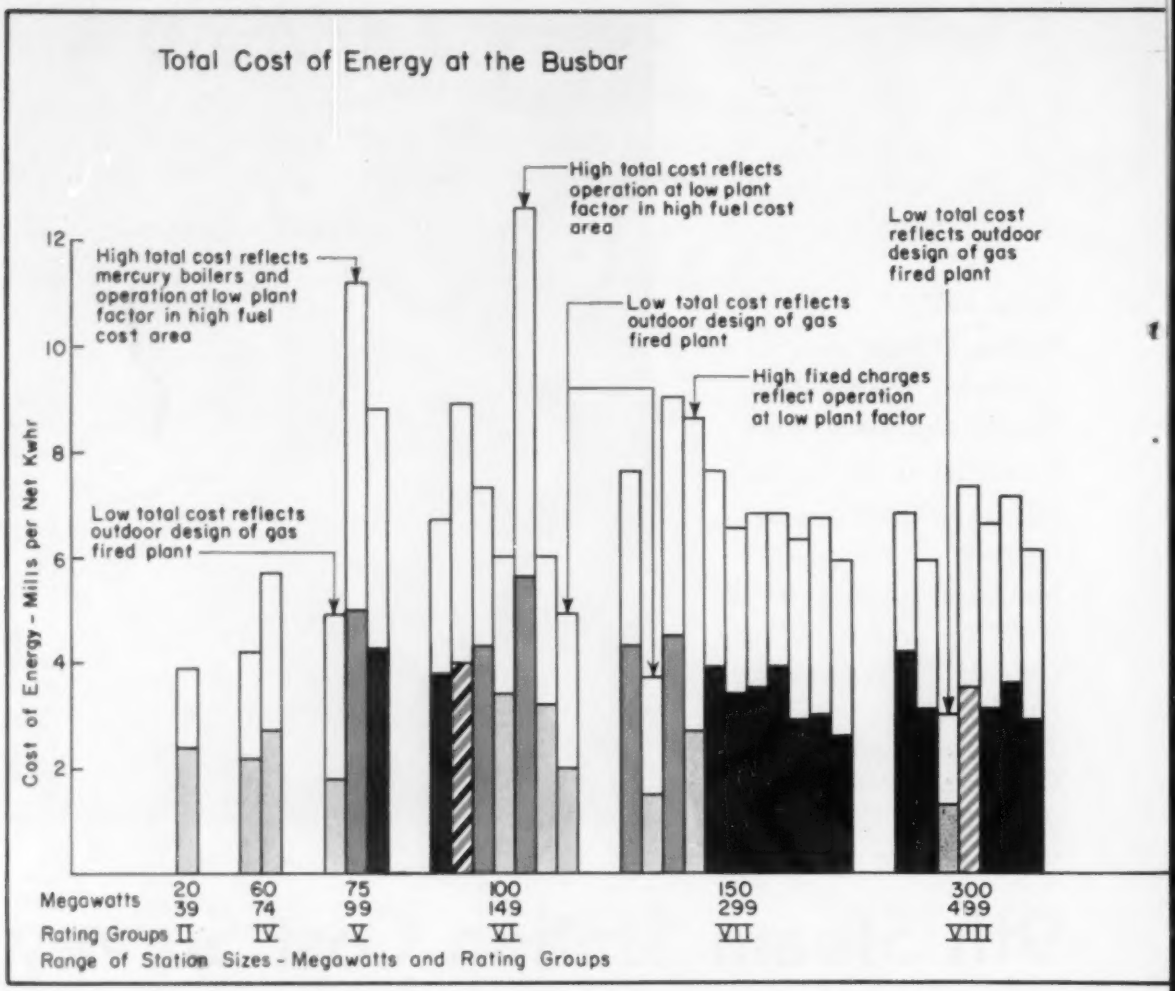
11. Reheat cycle was used by slightly less than half of the reporting stations. But on a capacity basis reheat was ahead 6,500-Mw reheat vs 5,350-Mw non reheat.

12. Average annual plant factor of 71.6% was about the same as that attained in 1952.

13. Average utilization factor was still about 100%.

14. Largest stations reached a record low for use of manpower with an average of 0.15 man per Mw for operation and maintenance duties.

15. Six percent of gross generated capacity was consumed by station auxiliaries.


Total Cost of Energy at the Busbar
High total cost reflects operation at low plant factor in high fuel cost area
Low total cost reflects outdoor design of gas fired plant
High total cost reflects mercury boilers and operation at low plant factor in high fuel cost area
Low total cost reflects outdoor design of gas fired plant
High fixed charges reflect operation at low plant factor
Low total cost reflects outdoor design of gas fired plant
Cost of Energy - Mills per Net Kwhr
12
10
8
6
4
2
Megawatts
20 39
60 74
75 99
100 149
150 299
300 499
Rating Groups II IV V VI VII VIII
Range of Station Sizes - Megawatts and Rating Groups

Busbar Energy Costs Unchanged

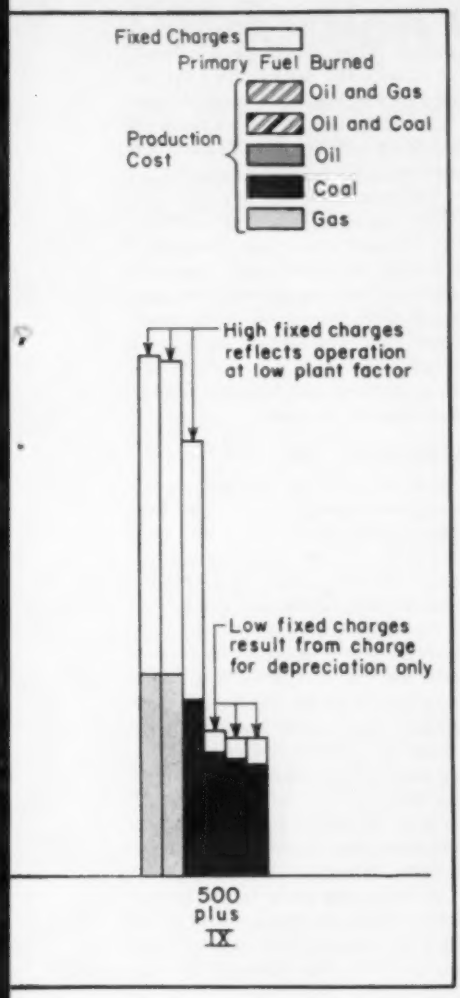
Average cost was 6 to 7 mills per net kwhr. Plant factor, investment charge, and plant location exerted biggest influence on overall cost; station size was not a factor. Ratio of fixed charges to production costs was mixed

The cost of producing a net kwhr of electricity in a modern power plant was between 6 and 7 mills in 1954. This is the same cost reported in 1952 (EW, Eighth Steam Station Cost Survey, July 13, 1953). In 1954 sixty percent of the reporting plants had a total cost of energy at the busbar of 7 mills per net kwhr or less, 76% eight mills or less, and 16% of the stations four mills or less. Average cost was 6.3 mills per net kwhr, with a low value of 3 mills, and a high of 12.5 mills.

Station size did not seem to have an influence on the cost of energy, perhaps because of the presence of several other factors. For example stations in the 500-Mw plus range did not give uniform results because half of the reporting stations operated at low plant factor and the others had unusually low annual investment charges.

In this survey, as in our previous one, the percentage used for annual investment charge was that reported by the participating utilities. It ranged from 2.8% for a public power station to a high of 17% reported by a private utility. Most of the utilities used a value between 12 and 15%, with about 50% of the participants reporting a value of 13 to 14%. The percentage used obviously had a marked effect on the fixed charges reported. Several stations with low or average station costs ended up with high fixed charges because of operation at low plant factor.

In addition to annual plant factor and size of investment charge, geo-

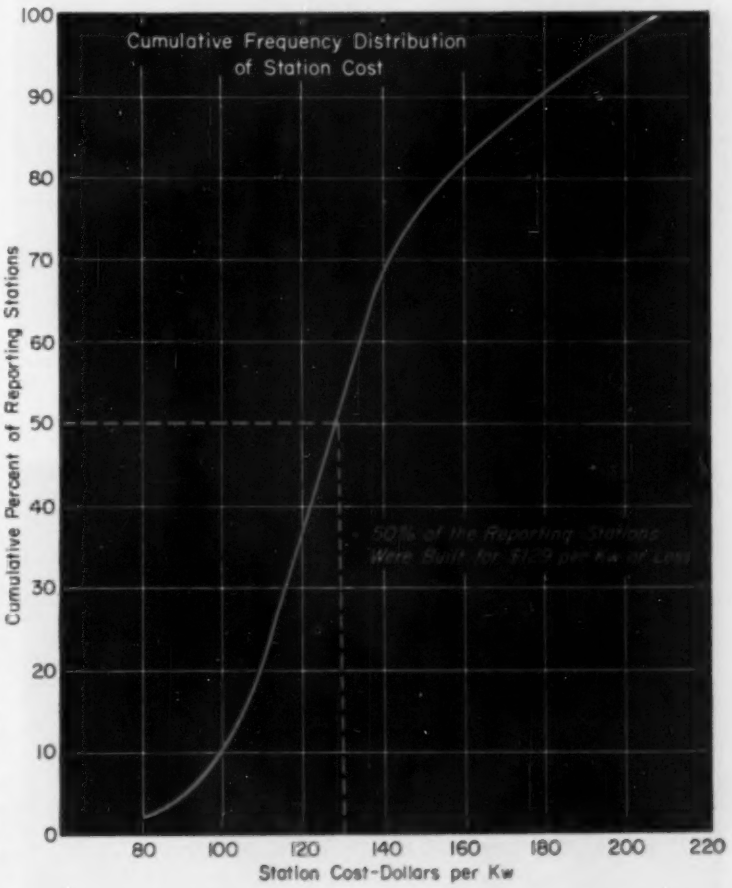


Station Costs Are Down

- **Station costs averaged $131 per kw in range of $100 to 170**
- **Outdoor gas fired plants were the most economical to build**
- **Boiler and turbine equipment accounted for 70% of costs**

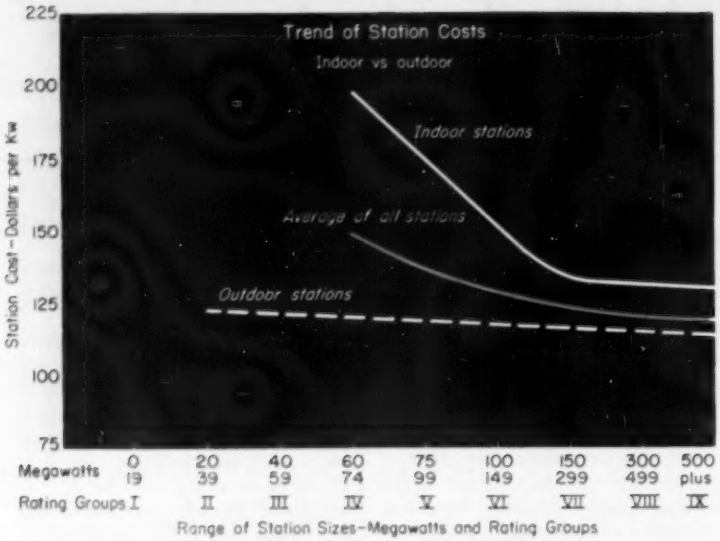
Fifty percent of the stations cost $129 per kw or less (excluding cost of switchyard facilities) to build. Seventy percent of the stations cost about $140 per kw or less. These figures indicate a continued downward trend in the cost of generating facilities. Average station cost in 1952 was $130-135, and the average in 1950 was $145-150. Gain is even more significant when it is remembered that most of the facilities were built during the period of sharply increasing labor and material costs following the outbreak of the Korean war. The lower costs that were achieved is certainly a tribute to the skill and resourcefulness of power plant designers. Reliance on larger generating units, centralized control, and outdoor design undoubtedly played an important part in this reduction of building costs.

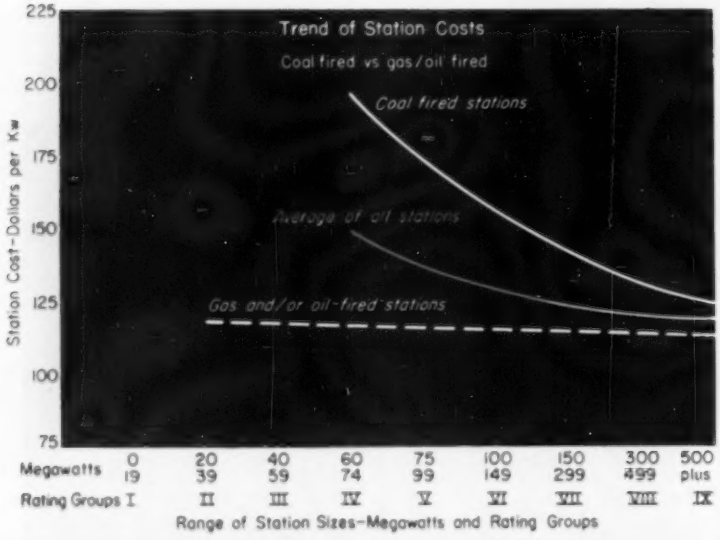
A closer analysis of costs indicate the effect of outdoor design and fuel. The charts on the following page show that the cheaper built plants are the outdoor ones and the plants burning gas or oil, particularly gas. However this trend of saving becomes less as station size increases. The representative outdoor stations in the 60 to 74-Mw range were built for a little more than half the cost of the average indoor stations. But the saving was not

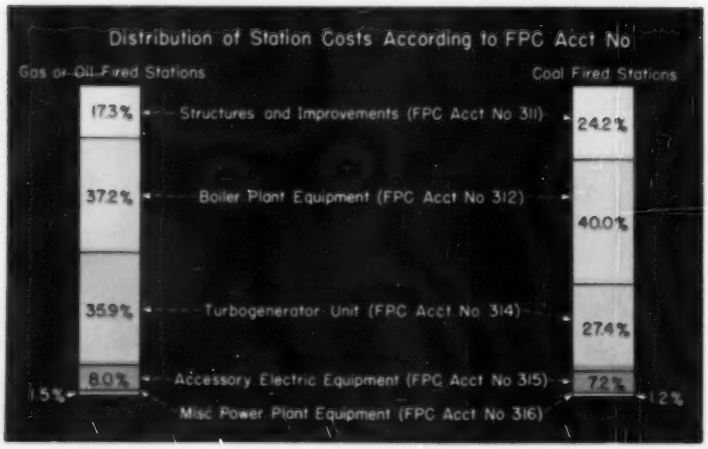


graphical location also played an important part in determining the cost of energy. Location in a low cost fuel area or a mild climate, thus permitting outdoor station design, usually meant lower energy costs. Gas burning stations and outdoor stations in the Southwest delivered power at the busbar at lower cost than other types of stations. In most instances the effect was considerable because gas burning plants were also of the outdoor design.

The rule of thumb resulting from the 1952 survey (Whatever the fuel, the production cost and fixed charges are about equal components of the total busbar cost) does not apply in the latest survey. Inspection of the bar chart above shows that about 2/3 of the stations did not divide these components equally.




Trend of Station Costs
Coal fired vs gas/oil fired
Coal fired stations
Average of all stations
Gas and/or oil-fired stations
Station Cost-Dollars per Kw
225
200
175
150
125
100
75
Megawatts 0 19 20 39 40 59 60 74 75 99 100 149 150 299 300 499 500 plus
Rating Groups I II III IV V VI VII VIII IX
Range of Station Sizes-Megawatts and Rating Groups



so great when the station sizes increased. There was a price differential of only $17 per kw when the station had 150 Mw of capacity or more. This is still considerable but not when compared with the $75-per-kw difference in the 60 to 74-Mw range.

The breakdown by fuel type also shows this same pattern of large savings at small plant sizes changing to a smaller saving at large plant size when coal burning stations were compared with gas or oil-fired plants. There is a seven-to-one decrease in advantage when the 60 to 74-Mw stations are compared with the 500-Mw plus range of stations.

Comparisons Can't Be Drawn

Caution must be exercised in trying to draw general conclusions from these curves. They give a very good indication of the trends in station costs. But they will not necessarily give an exact picture for each size because the curve is the trend of the averages in each rating group. In some instances indoor coal-burning plants have been built for less than outdoor gas-fired plants. One outstanding example is a 750-Mw indoor coal burning station that was built for $113.80 per kw (exclusive of switchyard facilities). This was less than the construction cost of two outdoor gas-burning plants in the same group.

Another important factor to consider in using the trend curves is that 75% of the outdoor stations burnt gas and 75% of the indoor burnt coal. Quantitative comparisons about the breakdown according to station type can't be drawn because the fuel used is not the same in both. Nor can they be drawn when classifying stations as to type of fuel used because the station design varies. However it is true that on the average gas or oil-fired plants cost less than coal-fired and outdoor plants cost less than indoor. These cost differentials decrease as size increases.

Boiler Account Largest

Investment in steam generating facilities and accessories (Federal Power Commission Account No. 312) continues to claim the largest portion of the building dollar. This is true regardless of the type of fuel the station is designed to burn. But the boiler account of the coal-fired plant takes the bigger bite—40%. Pulverizing, fuel handling, and ash handling equipment account for this.

Production Costs Are Less Than in '52

They varied greatly however because of the large spread in fuel costs. Maintenance expenses were lower

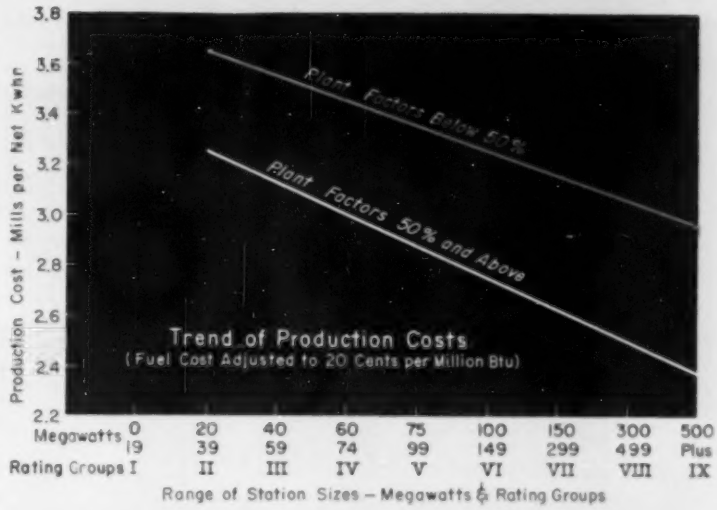
Average production or operating costs are down slightly. They average 3.1 mills per net kwhr for all the reporting stations. As usual fuel constitutes the largest portion of this cost—83%. This is a slight increase over the last survey when fuel accounted for 80% of operating expenses. Lower maintenance expenses undoubtedly contributed to this shift in the proportion of fuel charges. Approximately 65% of the stations showed maintenance expenses of 0.20 mills per kwhr or less. This even surpasses the low average of 0.25 mills per net kwhr achieved in 1950 and 1952.

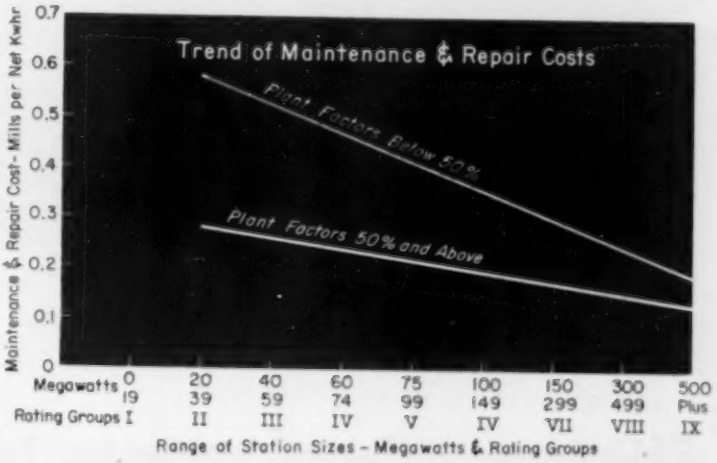
Plant Factor Affects Costs

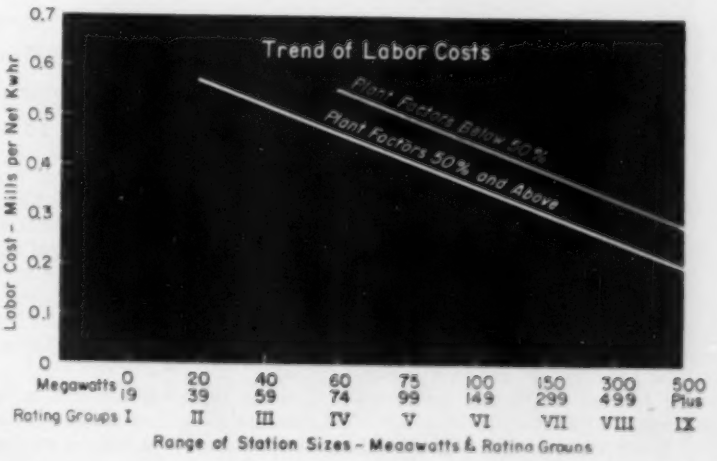
The variation of production cost with station size is obviously a function of plant factor as indicated in the charts at the right. The amount and kind of information in the survey required the division of plants into two categories—stations with plant factors above 50%, and those with plant factors below 50%. The charts indicate what would be suspected that the more a station is operated, the lower its unit costs will be.

Charts Indicate Trends

Although the charts again only indicate a trend, as was the case with the station cost curves, it is interesting to note the different effect plant factor has as station size increases. The rate of change of production costs (adjusted to a common fuel basis) is slightly larger for plants operating at the high plant factors. On the other hand the two trend lines of maintenance and repair costs converge as station size increases. This can be explained partly by the fact that we are again dealing with the averages of groups and partly by the fact that the large plants operating at low plant factor were among the newest in the survey and therefore had lower maintenance and repair expenses when compared with the other stations. This latter effect would increase the rate of change of the low plant factor curve


Trend of Production Costs
(Fuel Cost Adjusted to 20 Cents per Million Btu)
Plant Factors Below 50%
Plant Factors 50% and Above
Production Cost - Mills per Net Kwhr
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
Megawatts 0 19 | 20 39 | 40 59 | 60 74 | 75 99 | 100 149 | 150 299 | 300 499 | 500 Plus
Rating Groups I | II | III | IV | V | VI | VII | VIII | IX
Range of Station Sizes – Megawatts & Rating Groups


Trend of Maintenance & Repair Costs
Plant Factors Below 50%
Plant Factors 50% and Above
Maintenance & Repair Cost - Mills per Net Kwhr
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Megawatts 0 19 | 20 39 | 40 59 | 60 74 | 75 99 | 100 149 | 150 299 | 300 499 | 500 Plus
Rating Groups I | II | III | IV | V | IV | VII | VIII | IX
Range of Station Sizes – Megawatts & Rating Groups

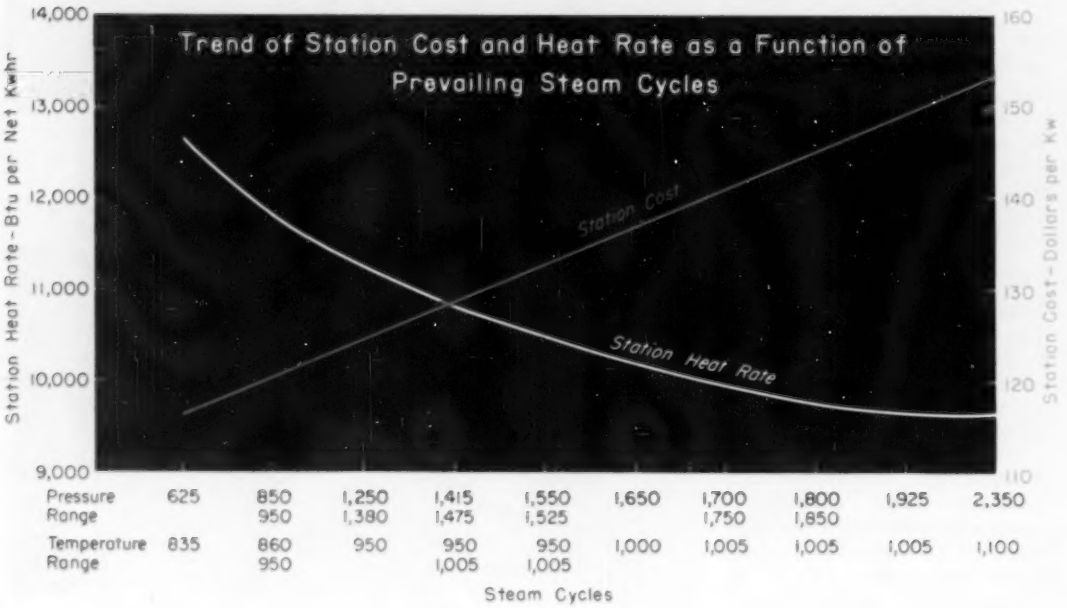

Trend of Labor Costs
Plant Factors Below 50%
Plant Factors 50% and Above
Labor Cost - Mills per Net Kwhr
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Megawatts 0 19 | 20 39 | 40 59 | 60 74 | 75 99 | 100 149 | 150 299 | 300 499 | 500 Plus
Rating Groups I | II | III | IV | V | VI | VII | VIII | IX
Range of Station Sizes – Megawatts & Rating Groups

and tend to cause the convergence.

Labor costs were only slightly lower for the stations operating at the higher plant factors indicating that manpower requirements remain fairly constant regardless of how much the equipment is operated.

Largest item in the maintenance account was the boiler. It outranked prime mover maintenance 7 to 5. The average cost of boiler maintenance was 0.071 mills per net kwhr, with a maximum value of 0.150 mills and a minimum of 0.010 mills. Corresponding figures for the turbine and its auxiliary equipment were 0.047, 0.140, and 0.007. Stations requiring fuel handling equipment also had an additional maintenance expense averaging 0.042 mills. It is interesting to note that this is almost as much as the cost of maintaining the turbine and its auxiliaries.

The results of the survey showed that the maintenance and repair expenses for an outdoor plant were only slightly higher than those of an indoor plant. Eighty-five percent of the indoor plants had maintenance expenses in the range of 0.09 to 0.29 mills per net kwhr while 75% of the outdoor plants had maintenance expenses falling into this same range. However, caution must be used in drawing generalized conclusions from these statistics because most of the indoor plants are coal fired. The burden of fuel handling maintenance expense thus falls more heavily on these plants.


Trend of Station Cost and Heat Rate as a Function of Prevailing Steam Cycles
Station Heat Rate - Btu per Net Kwhr
14,000
13,000
12,000
11,000
10,000
9,000
Station Cost - Dollars per Kw
160
150
140
130
120
110
Station Cost
Station Heat Rate
Pressure Range 625 850 950 1,250 1,380 1,415 1,475 1,550 1,525 1,650 1,700 1,750 1,800 1,850 1,925 2,350
Temperature Range 835 860 950 950 1,005 950 1,005 1,000 1,005 1,005 1,005 1,100
Steam Cycles

Efficiency Continues to Improve

Utilities have used the following to obtain better plant heat rates:

- **Higher temperatures, superheat steam in most of the plants 1,000F or better**
- **Higher pressures, 50% of capacity reported operate at 1,415 psi or better**
- **Reheat cycle, outranked the non-reheat cycle on a capacity basis by 6 to 5**

As was to be expected utilities paid more money for better heat rates, and they were willing to pay this price whenever the cost of their fuel was expensive. The chart above graphically shows part of this picture (higher station costs for better heat rates) and one of the charts on the following page depicts the rest of this line of reasoning (greater station cost to use expensive fuel more efficiently).

Better heat rates were obtained with increases in pressure and temperature and the use of reheat. The trend in station heat rate showed a change of 28% (12,650 to 9,600 Btu per net kwhr) when there was a change from a pressure of 625 psi and temperature of 835F to steam conditions of 2,350 psi and temperature of 1,100F (1,050F reheat).

On the average it appeared to be economical to increase station cost one dollar per kw above normal requirements for each improvement in heat rate of 74 Btu per net kwhr. In the lower temperature and pressure range increasing station cost one dollar per kw meant an improvement of 188 Btu per net kwhr; in the middle range the dollar per kw meant 80 Btu; while at higher temperatures and pressures the dollar per kw brought only a 30-Btu improvement in heat rate.

Another way to look at station performance is in terms of fuel cost.

Actually it is this item that determines the amount of money the engineer is willing to pay for increased efficiency. The survey shows the trend of station heat rate decreases exponentially as fuel costs increase. Station costs increase of course to pay the extra price of refinements to the heat cycle necessary for the increased efficiency. In 1952 a 5-to-1 increase in fuel cost was accompanied by an 11-to-6 increase in outlay to achieve a better utilization of the more expensive fuel. The comparative 1954 figures indicate that with a 5-to-1 increase in fuel cost, station costs increased in the ratio of about 8.5 to 6 (proportion given in terms of 1952 figures for comparison's sake). This again shows, as indicated in the section on station costs, that the plant designer is getting more for the dollar he spends on station design and construction.

Heat Rate Improves with Size

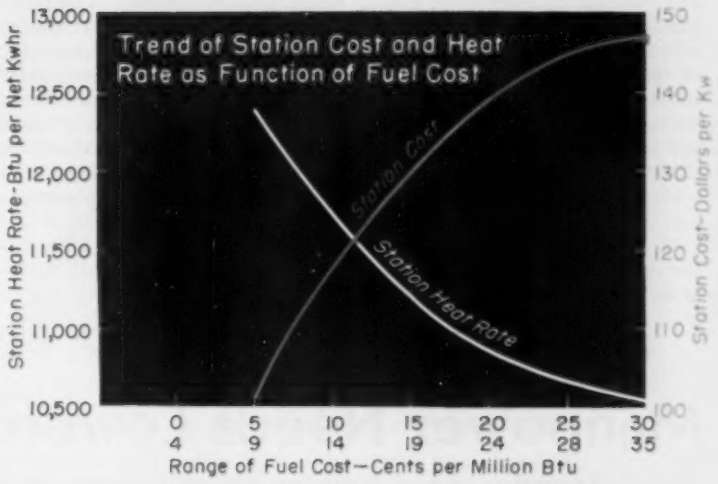
With the exception of one or two stations the spread in heat rate was not so large as in the previous survey. The range from high to low showed a 20% improvement. In 1952 the range from high to low was as great as 35%. The trend of station heat rate was downward from a high of 12,600 Btu per net kwhr in the 20-to-39-Mw range to a low of an average 10,500 Btu in the 500-Mw plus range. This of course reflects the higher fuel costs in the larger coal burning stations justifying the better station cycle conditions.

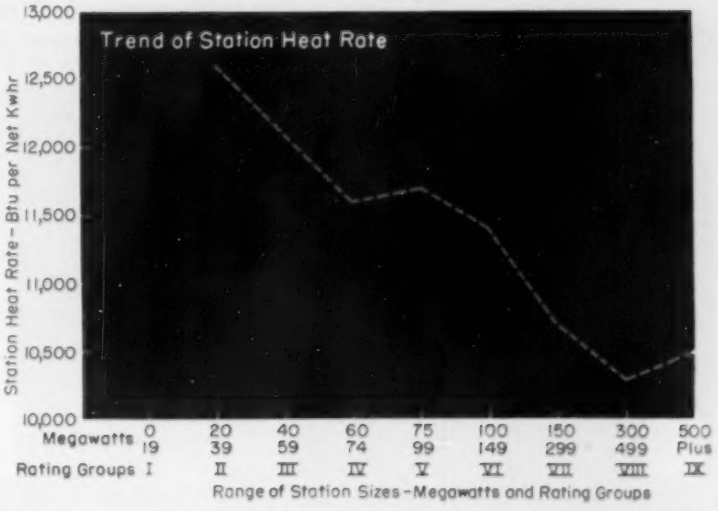
Plant loading was about the same as it was in 1952. Station plant factor averaged 71.6% with a spread in the averages of the various rating groups from 77% (300-to-499-Mw range) to 64.1% (110-to-149-Mw range). In 1952 the figure was about 70%, in 1950 about 80%.

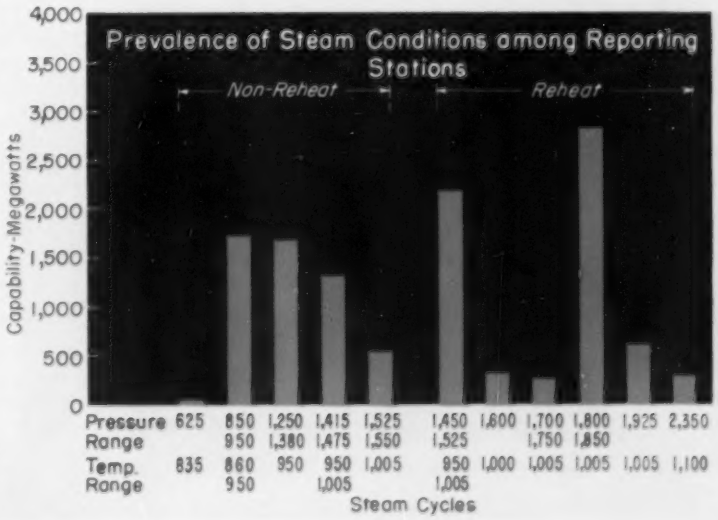
Utilization Factor Tops 100%

Plant factor did not show any relationship to station size. This of course should not necessarily be expected because it is more closely related to the efficiency, cost of operation, and location of stations in a particular operating system rather than to just mere size.

Utilization factor was still above 100%. It averaged 106.4% for plants of all sizes. This is a significant figure as utilization factor was reported on a capability basis rather than on a nameplate basis. Again there was no definite relationship between this figure




Trend of Station Heat Rate
Station Heat Rate-Btu per Net Kwhr
13,000
12,500
12,000
11,500
11,000
10,500
10,000
Megawatts 0 20 40 60 75 100 150 300 500
19 39 59 74 99 149 299 499 Plus
Rating Groups I II III IV V VI VII VIII IX
Range of Station Sizes-Megawatts and Rating Groups



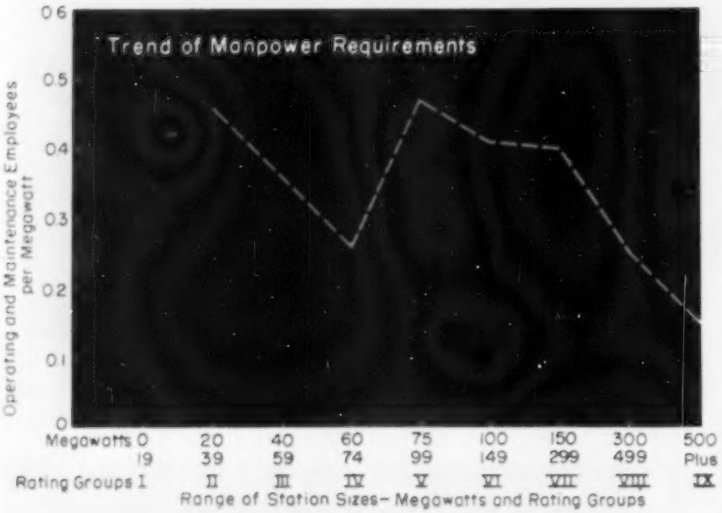
and plant size. If it were plotted as a function of station size, the trend line would be a horizontal line. Only six of the 54 reporting stations had a utilization factor less than 100%. And all of these were 95% or better. The highest value reported was 125.7%.

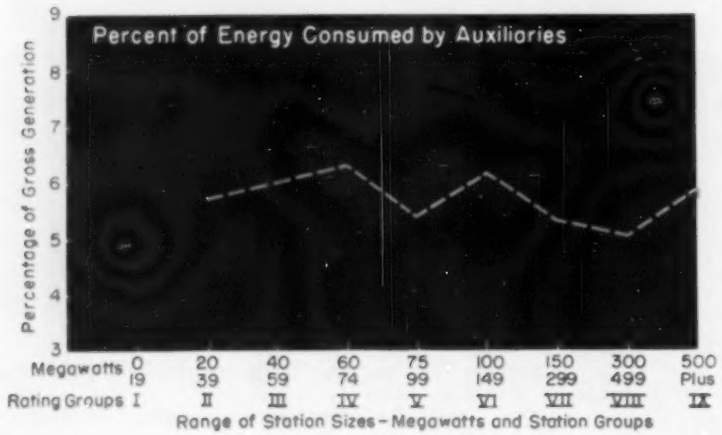
Utilities have resorted to higher temperatures and pressure for the purpose of getting better thermal performance. This has been the summary of the section on steam conditions for almost all of the eight previous surveys. This survey is no exception. Use of the reheat cycle has also been a contributing factor to better performance. Fifty-five percent of the capacity reported showed the use of the reheat cycle (6,500 Mw vs 5,350 Mw). In the 1952 survey the percentages were just about reversed, 60% non-reheat and 40% reheat.

Prevailing pressures were in the following brackets: 850-950 psi, 1,250-1,380 psi, 1,415-1,475 psi, 1,450-1,525 psi (reheat), and 1,800-1,850 psi (reheat). The 1,800-1,850 psi (reheat) bracket alone accounted for 24% of the capacity reported. Together with the 1,450-1,525 psi range the capacity reported was 43%. Comparison with the statistics of previous surveys stresses the significance of these results. In 1954 85% of the stations operated at a pressure of 1,200 psi or greater, in 1952 the figure was 80%, and in 1950 the figure was only about 33%.

Manpower Needs Lowered Sharply

Regardless of size, operating and maintenance employee requirements were less than in 1952. Total station needs averaged one man for every 2.56 megawatts of capacity. Six percent of generated power was used by auxiliaries


Trend of Manpower Requirements
Operating and Maintenance Employees per Megawatt
0.6
0.5
0.4
0.3
0.2
0.1
0
Megawatts 0 20 40 60 75 100 150 300 500
19 39 59 74 99 149 299 499 Plus
Rating Groups I II III IV V VI VII VIII IX
Range of Station Sizes – Megawatts and Rating Groups


Percent of Energy Consumed by Auxiliaries
Percentage of Gross Generation
9
8
7
6
5
4
3
Megawatts 0 20 40 60 75 100 150 300 500
19 39 59 74 99 149 299 499 Plus
Rating Groups I II III IV V VI VII VIII IX
Range of Station Sizes – Megawatts and Station Groups

Great strides have been made in the utilization of manpower in generating stations. Stations of all sizes averaged less than 0.5 operating and maintenance employee per Mw. In the last two preceding surveys manpower requirements of this small a magnitude were obtained only in large stations. The largest stations reporting in this survey (500 Mw plus) required only 0.15 man per Mw for the operation and maintenance of the station.

A sizeable betterment was made in the medium size plants (40-to-150-Mw range). Gains in this bracket were also very noticeable in the 1952 results. But the biggest gains were made in the very large stations where the needs were only about half of what they were in 1952 and 1950.

Other interesting statistics were obtained when the total manpower requirements were investigated. Just as in the case of operating and maintenance requirements total manpower needs were lowest for the largest stations. The ratio of differences as station size changed was of about the same magnitude as operating and maintenance requirements. The average value of total manpower requirements for all stations was one employee for every 2.56 Mw. For the largest stations (300 Mw and above) it was 3.3 Mw per man, for the medium size plants (100-299 Mw) 2.56 Mw, and for the smallest plants 1.69 Mw.

Station auxiliaries claimed about 6% of the gross generating capacity.

The trend of this percentage is almost constant regardless of station size. There might be a slight decrease in the percentage of the power required as station size increases. The wide range of power requirements evident in the 1952 figures did not appear in this survey. Although there were two stations using 8% of gross generation for auxiliaries and three using only 4%, 70% of the stations used a figure somewhere between 5 and 6.5%.

Breaking down auxiliary requirements according to the type of fuel burned showed that only in coal-fired plants did the percentage of auxiliary power used decrease with an increase in station size. In oil fired plants it remained fairly constant at about 5%. Percentage of auxiliary power required for gas-fired stations actually increased as station size increased. However, the survey did not contain enough information in each rating group to ascertain this as a definite trend. In almost all rating groups the coal-fired stations on the average used a smaller percentage of auxiliary power than did the other stations which burned either gas or oil.

Outdoor Plants Grow in Popularity

Station designers continued to resort to outdoor design to keep down costs. Design of indoor plants also showed progress with decreased volume requirements for boiler and turbine rooms. The use of cooling towers was noticeable

Tabulation of design features showed a large number of stations have placed equipment outdoors. Fifty-eight percent have outdoor fans, 48% outdoor boilers, 20% outdoor turbines, and 17% outdoor condensers.

Reliance on demineralization for water purity has increased about 450% since the preceding survey. In 1952 three of the 43 reporting plants used demineralization, in 1954 17 of the 54 plants reported use of this equipment.

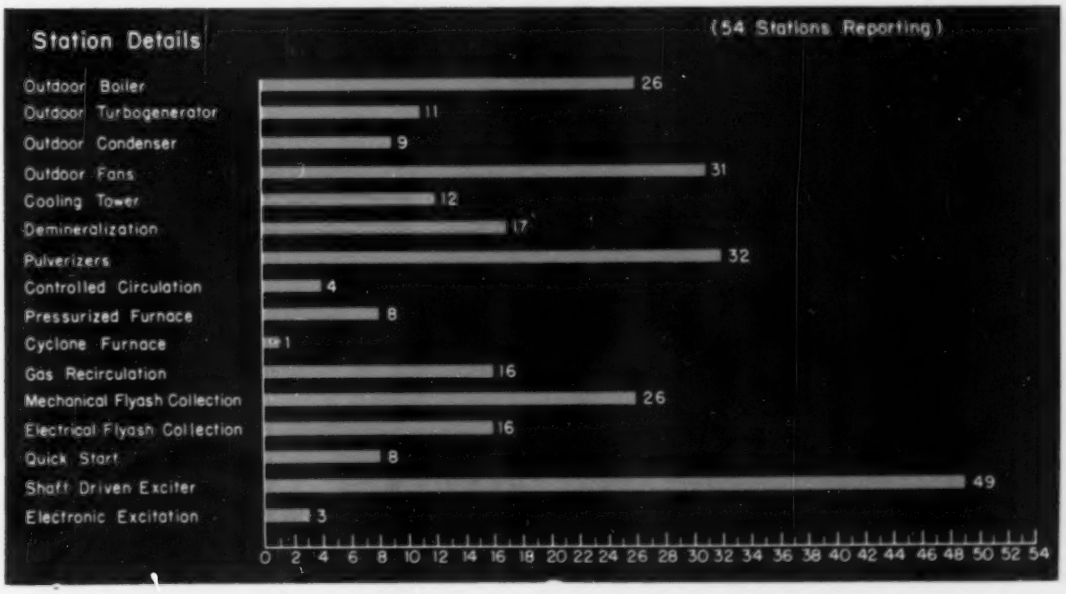
All of the coal-burning plants except one had some type of flyash collection equipment. Nine coal-fired plants had both electric and mechanical collectors. Two plants designed to burn oil only also had some type of precipitator.

Shaft-driven exciters are still the choice of the designers. Forty-nine of the 54 plants reported this type; nine stations reported electronic excitation.

The amount of coal kept on hand for emergencies has increased slightly since 1952. About one ton per kw is the average with a high value of 2.88 tons per kw for a station in the 500-Mw plus range and a low of 0.41 tons per kw for a station in the 100 to 149-Mw range. Station size did not influence the reserve requirements. In 1952 the tendency was to keep about ¾ tons per kw of coal in reserve.

The average boiler room volume of the newest stations (indoor plants only) was 13 cu ft per kw. This indicates a continuation of the decrease evident in the preceding surveys. Plants operating in 1952 had an average boiler room volume of 15 cu ft per kw, plants of 1950 vintage averaged 18 cu ft per kw. Increased boiler pressure undoubtedly contributed to this decrease in volume requirements.

The statistics relating to the turbine room showed the same type of picture. Average in 1954, 8.5 cu ft per kw; in 1952, 9.5 cu ft per kw; and in 1950, 10 cu ft per kw.



Cost and Performance Data of 54 Modern Steam Stations

Station Number†	234	235	236(191)	237	238	239(195)	240(194)	241	242	243(196)	244
GENERAL DATA											
Year, first operation	1953	1952	1951	1953	1953	1950	1951	1953	1952	1948	1953
newest unit	1954	1954	1953	1955	1954	1952	1953	1954	1954	1953	1954
Total generator rating (MMRC)*	IX	IX	IX	IX	IX	IX	IX	VIII	VIII	VIII	VIII
No. of turbogenerators	7	6	6	4	4	5	5	3	4	6	2
Range of unit ratings*	VII	VI	VI	VII	VII	VI	VI	VI	VI	IV	VII
No. of boilers	7	6	6	4	4	8	8	3	4	6	2
Range of ratings (M lb/hr)	1,000	850&1,000	1,000	1,200	1,070	550&850	550&850	875	675	430&500	1,370
Steam pressure (psi)	1,825	1,475&1,825	1,475	1,925	1,850	1,405&1,450	1,405&1,500	1,850	1,492	1,350&1,500	1,800
Stm temp, initial supht (F)	1,003	1,003	1,003	1,055	1,000	950&1,000	950&1,000	1,050	1,000	950&1,000	1,000
reheat (F)	1,003	1,003	.....	1,005	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Cooling water range (F)	38–86	44–83	40–89	38–84	34–70.1	56–63	45–76	33–72	37–76	43–103	33–77
Corresponding vacuum (in. Hg)	.77–2.45	.75–1.95	.70–2.2	1.04–2.63	.72–1.60	.....	.....	.76–1.67	.43–1.54	1.0–3.8	.77–1.48
Plant site area (acres)	2,735	690	598	610	415	272	198	162	168	251	61
In use (acres)	127	59	82	.....	415	272	198	162	75	79	13
Fuel storage, coal (tons)	1,450,000	540,000	610,000	750,000	1,800,000	.....	.....	1,000,000	186,000	250,000	305,000
Oil (bbl)	.....	.....	.....	952	125,000	720,000	600,000	218	.....	.....	.....
Employees, total	409	344	345	251	168	141	116	119	107	153	61
Operation	158	129	130	105	64	71	65	60	55	62	36
Maintenance	102	78	82	94	34	58	36	33	17	67	9
Clerical, stores	14	14	13	17	8	12	15	5	11	9	6
Fuel handling	77	68	66	34	25	.....	.....	12	11	9	5
Guards	14	14	14	.....	13	.....	.....	9	.....	4	5
OUTPUT DATA											
Total gross gen (kwhr x 10^6)	5,517	5,847	5,970	4,403	2,702	1,970	1,772	2,350	2,103	2,170	2,542
Total net gen (kwhr x 10^6)	5,230	5,574	5,658	4,129	2,558	1,817	1,645	2,223	2,019	2,046	2,427
Maximum 1-hr peak (Mw)	1,093	840	785	754	640	590	591	434	393	400	375
Hours operation 1954	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	.....	8,760	8,554
FUEL CONSUMPTION DATA											
Coal (tons)	2,179,812	2,181,981	2,486,597	1,734,000	952,441	.....	.....	850,590	732,874	768,339	8,814
Btu/lb	11,690	12,570	11,540	11,806	12,380	.....	.....	12,256	13,340	13,279	13,298
Ash (%), moisture (%)	10.3; 9.1	11.1; 5.3	9.8; 9.9	9.0; 8.0	9.4; 7.3	.....	.....	12.1; 5.2	7.9; 4.1	6.5; 5.1	9.3; 2.5
Cost (¢/million Btu)	16.63	18.58	17.55	18.90	28.40	.....	.....	26.30	36.30	25.52	33.16
Oil (bbl)	.....	.....	.....	15,800	5,860	234,728	85,775	3,377	.....	.....	948,734
Btu/gal	.....	.....	.....	138,080	139,900	148,810	148,810	138,707	.....	.....	149,253
Cost (¢/million Btu)	.....	.....	.....	84.50	77.20	25.78	26.70	79.15	.....	.....	34.91
Gas (M cu ft)	.....	.....	.....	.....	.....	19,083,448	17,968,841	.....	.....	.....	16,539,685
Btu/cu ft	.....	.....	.....	.....	.....	1,110	1,068	.....	.....	.....	1,060
Cost (¢/million Btu)	.....	.....	.....	.....	.....	25.95	26.14	.....	.....	.....	30.57

Station Number†	234	235	236(191)	237	238	239(195)	240(194)	241	242	243(196)	244
OPERATING COSTS (Mills per net kwhr)											
Fuel	1.694	1.874	1.825	1.903	2.616	3.242	3.230	2.473	3.202	2.62	3.12
Wages (incl supervision)	0.178	0.189	0.200	0.219	0.344	0.331	0.305	0.334	0.242	0.21	0.21
Water, lubrication, supplies	0.040	0.033	0.044	0.035	0.092	0.067	0.149	0.036	0.050	0.03	0.05
Maintenance	0.164	0.113	0.173	0.061	0.276	0.142	0.160	0.075	0.150	0.20	0.14
Total, oper & mtce (excl fuel)	0.382	0.335	0.417	0.315	0.712	0.540	0.614	0.445	0.442	0.44	0.40
Total operation (incl fuel)	2.076	2.209	2.269	2.218	3.328	3.782	3.844	2.918	3.644	3.06	3.52
INVESTMENT DATA (Dollars per kw)											
**(310) Land	0.44	0.15	0.07	.....	1.00	0.82	0.77	1.46	0.42	0.51	1.50
(311) Structure, improvements	30.14	24.17	25.23	.....	39.39	2.80	11.42	32.57	29.47	30.49	51.80
(312) Boiler plant equipment	58.53	45.15	44.33	.....	59.76	59.35	58.79	46.59	47.04	49.79	79.10
(314) Turbogenerator unit	39.36	34.25	37.64	.....	36.06	38.89	33.74	30.21	37.70	34.17	35.40
(315) Accessory elec equipment	8.32	7.62	6.65	.....	12.82	13.55	9.06	5.26	4.97	9.27	21.70
(316) Misc plant equipment	1.43	1.67	1.88	.....	2.99	1.60	1.94	1.13	1.57	0.94	1.70
Total station	138.22	113.01	115.80	.....	152.02	127.01	115.72	117.22	121.18	125.17	191.20
Outdoor switchyard	7.28	6.43	8.15	.....	4.82	10.32	11.22	4.12	7.73	7.71	13.80
Total, station and switchyard	145.50	119.44	123.95	.....	156.84	137.33	126.94	121.34	128.91	132.88	205.00
COST OF ENERGY (Mills per net kwhr)											
Fixed charges	.511	.361	.432	.....	4.907	5.878	5.970	3.209	3.465	3.52	3.75
Computed at (%)	2.797	2.797	2.797	.....	12.5	13.09	13.09	14.0	14.0	14.47	13.75
Operating charges	2.076	2.209	2.269	2.218	3.328	3.782	3.844	2.918	3.644	3.06	3.52
Total	2.587	2.570	2.701	.....	8.235	9.660	9.814	6.127	7.109	6.58	7.27
STATION PERFORMANCE 1954											
Billion Btu used	50,964	54,855	57,391	41,000	23,620	22,703	19,752	20,869	19,553	20,475	23,709
Fuel cost (¢/million Btu)	17.31	19.06	18.24	18.93	28.10	25.94	26.90	26.35	36.30	25.52	31.68
Btu/net kwhr send out	9,740	9,840	10,140	9,940	9,240	12,497	12,007	9,386	9,686	10,004	9,767
Btu/gross kwhr generated	9,240	9,380	9,610	9,321	8,740	1,524	11,149	8,880	9,298	9,433	9,327
Average boiler efficiency (%)	87.41	85.97	86.19	86.35	89.60	.....	.....	88.60	89.00	90.34	84.70
Station thermal eff, net (%)	35.00	34.70	33.70	34.33	36.90	36.62	35.18	36.40	35.24	34.11	35.00
Employees per 1,000 kw per day	0.150	0.160	0.170	0.425	0.157	0.245	0.202	0.181	0.210	0.293	0.140
Plant factor, annual (%)	93.6	89.0	90.9	101.7	45.6	39.1	33.91	88.6	57.6	66.1	86.6
Utilization factor, annual (%)	104.1	112.0	104.7	120.0	100.0	102.6	102.8	103.2	98.3	106.7	104.2

Additional Information (listed by station number):

234, 235, 236 Fixed charges represent depreciation only.

238 Total number of employees includes 12 superintendents and 12 janitors.

239 Corresponding vacuum for reheat units is 2.18 to 2.70 in., for non-reheat 1.58 to 1.70 in.

240 Corresponding vacuum for reheat units is 1.06 to 2.10 in., for non-reheat 0.87 to 1.94 in.

241 Operating capability used.

242 Total hours operation of individual units was 26,005.58.

244 Maintenance crew of 100 men assigned to station during periodically scheduled outages.

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

* Rating Groups (Manufacturer's Maximum Rated Capability), Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

** Electric plant account numbers prescribed by Federal Power Commission

Cost and Performance Data of 54 Modern Steam Stations

Station Number†	245(199)	246	247(155)	248(200)	249	250	251	252(119)	253	254(153)	255(203)
GENERAL DATA											
Year, first operation	1952	1952	1949	1952	1941	1953	1953	1949	1952	1951	1951
newest unit	1954	1954	1952	1953	1951	1953	1954	1953	1954	1953	1953
Total generator rating (MMRC)*	VIII	VIII	VIII	VIII	VIII	VII	VII	VII	VII	VII	VII
No. of turbogenerators	3	3	4	3	4	2	2	5	3	3	3
Range of unit ratings*	VI	VI	IV-VI	VI	IV-V	VI	VI	III-IV	IV-VI	IV-VI	V
No. of boilers	3	3	4	3	4	2	2	5	3	3	3
Range of ratings (M lb/hr)	860&875	706&820	675&950	690&850	640&725	955	925	400&600	700&1,000	625&750	510
Steam pressure (psi)	1,250&1,450	1,500&1,850	920&1,525	1,650	890	2,350	1,500	850&1,250	850&1,450	1,325&1,525	1,450
Stm temp, initial supht (F)	950&1,000	1,005	905&1,005	1,000	910&950	1,100	950	900&950	900&1,000	955&1,005	1,000
reheat (F)	1,000	1,005	.....	1,000	.....	1,050	950	.....	1,000	1,005	1,000
Cooling water range (F)	33–83	32–85	72–94	33–85	35–75	35–85	35–87	32–95	32–84	35–84	40–78
Corresponding vacuum (in. Hg)	.8–2.0	.7–2.5	1.8–3.1	.5–2.0	.72–1.47	.....	.7–2.5	.8–3.5	2.4–1.4	.59–2.1	1.03–2.17
Plant site area (acres)	57	670	401	700	51	.....	374	575	47	190	27
In use (acres)	57	220	401	69	36	.....	68	353	47	.....	27
Fuel storage, coal (tons)	240,000	250,000	.....	400,000	500,000	.....	350,000	300,000	225,000	500,000	70,000
Oil (bbl)	.....	.....	25,000	.....	200	.....	.....	4,200	286	.....	1,048
Employees, total	109	124	79	105	191	.....	118	108	55	100	88
Operation	43	67	37	62	111	.....	53	64	31	58	55
Maintenance	22	29	32	20	48	.....	47	26	18	16	20
Clerical, stores	5	4	.....	2	5	.....	5	4	2	5	4
Fuel handling	13	18	.....	19	23	.....	13	9	4	8	9
Guards	.....	6	4	4	4	.....	.....	5	.....	.....	.....
OUTPUT DATA											
Total gross gen (kwhr x 10^6)	1,926	1,665	2,299	2,313	1,447	2,061	1,669	1,579	1,408	1,590	1,503
Total net gen (kwhr x 10^6)	1,831	1,573	2,160	2,212	1,357	1,911	1,586	1,495	1,404	1,499	1,434
Maximum 1-hr peak (Mw)	334	332	364	328	290	306	272	271	288	242	240
Hours operation 1954	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,757
FUEL CONSUMPTION DATA											
Coal (tons)	774,255	645,677	.....	880,893	659,936	675,750	474,533	724,973	715,349	602,625	515,892
Btu/lb	12,284	12,236	.....	12,023	12,152	13,252	12,416	11,445	11,127	11,169	13,629
Ash (%), moisture (%)	12.6; 5.3	11.3; 5.7	.....	12.3; 7.0	11.7; 6.3	9.3; 3.8	12.5; 4.1	8.2; 12.4	19.5; 5.2	11.0; 11.0	9.1; 4.2
Cost (¢/million Btu)	18.84	18.90	.....	28.75	26.60	32.70	22.03	22.40	11.87	23.10	33.80
Oil (bbl)	.....	.....	883	.....	1,417	55,907	.....	3,464	2,923	.....	11,780
Btu/gal	.....	.....	147,600	.....	138,075	.....	.....	138,500	138,450	.....	137,200
Cost (¢/million Btu)	.....	.....	23.40	.....	75.21	33.40	.....	80.60	95.59	.....	76.00
Gas (M cu ft)	.....	.....	23,900,000	.....	.....	.....	3,968,400	.....	.....	2,536,799	.....
Btu/cu ft	.....	.....	1,070	.....	.....	.....	1,058	.....	.....	941	.....
Cost (¢/million Btu)	.....	.....	8.49	.....	.....	.....	17.91	.....	.....	19.90	.....

Station Number†	245(199)	246	247(155)	248(200)	249	250	251	252(119)	253	254(153)	255(203)
OPERATING COST (Mills per net kwhr)											
Fuel	2.019	1.894	1.006	2.75	3.149	3.130	2.04	2.49	1.400	2.40	3.37
Wages (incl supervision)	0.228	0.245	0.110	0.20	0.822	0.207	0.29	0.28	0.121	0.28	0.20
Water, lubrication, supplies	0.043	0.085	0.012	0.03	0.029	0.057	0.07	0.05	0.024	0.08	0.03
Maintenance	0.098	0.159	0.141	0.10	0.175	0.472	0.22	0.13	0.167	0.13	0.28
Total, oper & mtce (excl fuel)	0.369	0.489	0.263	0.33	1.026	0.736	0.58	0.46	0.312	0.49	0.51
Total operation (incl fuel)	2.388	2.383	1.269	3.08	4.175	3.866	2.62	2.95	1.712	2.89	3.88
INVESTMENT DATA (Dollars per kw)											
**(310) Land	0.51	0.28	0.29	0.65	0.87	.....	0.57	0.32	0.25	0.95	0.30
(311) Structure, improvements	42.27	47.70	8.60	39.01	21.03	21.40	39.06	29.70	18.83	33.20	31.40
(312) Boiler plant equipment	60.42	61.20	25.68	50.57	32.41	73.54	77.39	50.33	55.93	61.80	66.00
(314) Turbogenerator unit	40.15	37.60	33.63	32.54	22.81	36.20	53.57	37.56	41.54	41.45	35.52
(315) Accessory elec equipment	12.76	9.94	6.11	7.22	3.24	18.31	20.92	8.28	8.94	12.35	12.48
(316) Misc plant equipment	3.41	2.31	0.17	1.01	1.21	0.69	1.63	0.24	1.24	1.35	1.59
Total station	159.53	159.03	74.48	131.00	81.57	150.14	193.14	126.24	126.73	151.10	147.29
Outdoor switchyard	.....	8.86	6.19	7.92	1.59	8.26	6.19	11.19	5.45	10.46	3.86
Total, station and switchyard	.....	167.89	80.68	138.92	83.16	158.40	199.33	137.43	132.18	161.56	151.15
COST OF ENERGY (Mills per net kwhr)											
Fixed charges	.....	.....	1.73	2.83	2.608	.....	3.30	3.76	.....	3.41	2.96
Computed at (%)	.....	.....	15.0	.....	14.0	.....	14.0	15.5	.....	13.5	12.5
Operating charges	2.388	2.383	1.27	3.08	4.175	.....	2.62	2.95	1.712	2.89	3.88
Total	.....	.....	3.00	5.91	5.783	.....	5.92	6.71	.....	6.30	6.84
STATION PERFORMANCE 1954											
Billion Btu used	19,022	15,820	25,570	21,181	16,047	18,263	15,986	16,615	15,935	15,848	14,090
Fuel cost (¢/million Btu)	19.43	18.90	8.49	28.75	26.63	32.80	22.00	22.40	12.34	22.60	33.80
Btu/net kwhr send out	10,389	10,046	11,848	9,574	11,827	9,556	10,080	11,099	11,350	10,573	9,851
Btu/gross kwhr generated	9,875	9,495	11,124	9,156	11,087	8,861	9,580	10,520	10,813	9,950	9,402
Average boiler efficiency (%)	89.9	88.5	84.3	90.6	88.9	88.0	88.0	90.1	87.5	88.0	89.9
Station thermal eff, net (%)	32.79	33.97	28.8	35.7	28.9	35.7	34.0	30.8	30.5	32.3	34.7
Employees per 1,000 kw per day	0.200	0.359	.....	0.250	0.418	.....	0.264	0.290	0.209	0.284	0.367
Plant factor, annual (%)	87.3	.....	79.0	77.7	68.6	81.1	90.6	68.3	99.3	78.2	71.5
Utilization factor, annual (%)	102.7	96.4	109.6	100.9	95.4	105.5	100.9	102.7	109.4	103.7	100.0

Additional Information (listed by station number):

245 Total number of employees includes 10 for supervision and technical positions and 16 for miscellaneous assignments.

249 Operating capability used.

255 Plant factor, utilization factor, and employees per 1,000 kw per day based on operating capability.

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

* Rating groups (Manufacturer's Maximum Rated Capability), Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

** Electric plant account numbers prescribed by Federal Power Commission

Cost and Performance Data of 54 Modern Steam Stations

Station Number†	256	257	258	259	260	261(166)	262(220)	263(159)	264	265	266
GENERAL DATA											
Year, first operation	1950	1953	1953	1949	1953	1949	1951	1948	1952	1923	1951
newest unit	1951	1954	1954	1949	1953	1954	1953	1953	1953	1954	1952
Total generator rating (MMRC)*	VII	VII	VII	VII	VII	VII	VII	VII	VI	VI	VI
No. of turbogenerators	2	2	2	2	2	5	2	4	2	2	2
Range of unit ratings*	VI	VI	VI	VI	V	I-IV	IV-V	II-III	III-IV	IV-V	IV-V
No. of boilers	4	2	2	2	2	5	2	5	2	2	2
Range of ratings (M lb/hr)	660	750	656	950	900	150–650	625&950	200–440	500&1,000	630&675	575&620
Steam pressure (psi)	1,380	1,500	1,492	890	1,750	650–1,525	1,350&1,550	875	850&1,260	920&1,350	1,415&1,525
Stm temp, initial supht (F)	950	1,000	1,000	950	1,005	835–1,005	955&1,005	850	900&950	905&955	950&1,000
reheat (F)	.....	1,000	1,000	.....	.....	1,005	.....	.....	.....	.....	1,000
Cooling water range (F)	35–77	44–84	33–72	34–75	42–97	59–95	43–88	57–89	65–85	60–95	68–86
Corresponding vacuum (in. Hg)	.....	.5–2.1	.38–1.45	.64–1.4	.65–3.02	.....	1.1–2.7	1.0–2.6	1.0–2.0	1.0–3.5	1.73–2.4
Plant site area (acres)	84	265	96	95	816	83	.....	35	354	32	42
In use (acres)	84	72	96	50	816	50	40	28	60	32	42
Fuel storage, coal (tons)	600,000	200,000	803,000	500,000	.....	.....	.....	.....	.....	.....	100,000
Oil (bbl)	.....	9,850	.....	218	60,000	165,000	10,000	270,000	40,000	60,000	60,000
Employees, total	137	83	50	126	44	100	44	85	47	116	78
Operation	56	33	35	52	28	63	22	56	38	63	42
Maintenance	20	28	15	44	12	30	18	23	8	44	27
Clerical, stores	7	1	.....	12	4	7	.....	.....	1	4	6
Fuel handling	14	10	.....	15	.....	.....	.....	2	.....	.....	.....
Guards	14	.....	.....	3	.....	.....	.....	4	.....	5	.....
OUTPUT DATA											
Total gross gen (kwhr x 10^6)	1,601	813	1,245	995	597	909	.....	1,022	702	723	548
Total net gen (kwhr x 10^6)	1,513	772	1,183	939	562	860	1,132	972	655	674	511
Maximum 1-hr peak (Mw)	220	222	209	201	215	238	188	168	162	235	77
Hours operation 1954	8,760	8,655	7,855	8,760	7,615	8,760	8,760	8,760	8,327	8,760	7,973
FUEL CONSUMPTION DATA											
Coal (tons)	1,156,899	281,907	421,000	411,471	.....	.....	.....	.....	.....	.....	16,077
Btu/lb	12,660	13,579	13,437	12,663	.....	.....	.....	.....	.....	.....	12,608
Ash (%), moisture (%)	8.6; 7.0	7.5; 4.4	8.5; 3.7	10.4; 4.1	.....	.....	.....	.....	.....	.....	8.0; 8.0
Cost (¢/million Btu)	27.60	30.86	29.75	26.44	.....	.....	.....	.....	.....	.....	26.00
Oil (bbl)	.....	.....	.....	3,156	16,208	1,535,932	.....	1,797,704	417	60,158	93,620
Btu/gal	.....	.....	.....	138,152	157,200	151,060	.....	151,612	140,000	146,071	150,000
Cost (¢/million Btu)	.....	.....	.....	78.95	43.00	33.40	.....	31.80	62.78	44.37	23.70
Gas (M cu ft)	16,084	.....	.....	.....	5,806,185	.....	11,929,523	.....	7,450,000	8,020,542	4,950,000
Btu/cu ft	975	.....	.....	.....	1,002	.....	1,048	.....	1,000	1,067	908
Cost (¢/million Btu)	76.10	.....	.....	.....	19.20	.....	11.40	.....	13.54	7.20	22.80

Station Number†	256	257	258	259	260	261(166)	262(220)	263(159)	264	265	266
OPERATING COSTS (Mills per net kwhr)											
Fuel	2.936	3.07	2.851	2.951	2.16	3.78	1.26	3.75	1.54	0.991	2.495
Wages (incl supervision)	0.402	0.24	0.332	0.780	0.29	0.40	0.10	0.29	0.23	0.499	0.180
Water, lubrication, supplies	0.074	0.09	0.045	0.036	0.06	0.06	0.04	0.06	0.10	0.066	0.125
Maintenance	0.133	0.26	0.159	0.137	0.16	0.29	0.08	0.19	0.10	0.652	0.215
Total, oper & mtce (excl fuel)	0.609	0.59	0.536	0.953	0.51	0.75	0.22	0.54	0.43	1.217	0.520
Total operation (incl fuel)	3.545	3.66	3.387	3.904	2.67	4.53	1.48	4.29	1.97	2.208	3.015
INVESTMENT DATA (Dollars per kw)											
**(310) Land	1.55	1.00	.....	1.27	1.56	0.36	2.20	2.70	1.86	.....	0.55
(311) Structure, improvements	45.17	26.20	25.61	39.85	14.97	22.42	8.20	23.23	17.62	14.30	31.10
(312) Boiler plant equipment	73.38	56.50	58.11	42.99	42.48	56.05	37.70	40.09	38.43	28.80	74.14
(314) Turbogenerator unit	32.17	43.30	41.33	24.89	35.95	41.05	39.20	45.83	49.07	33.80	51.51
(315) Accessory elec equipment	14.89	8.40	4.85	8.21	7.51	10.31	7.20	8.61	7.58	17.90	12.27
(316) Misc plant equipment	2.02	1.30	1.98	1.64	2.12	1.09	1.50	2.33	0.59	0.40	0.44
Total station	169.18	136.70	131.88	118.85	104.59	131.28	96.00	122.79	115.15	95.20	170.10
Outdoor switchyard	8.50	8.40	7.20	6.15	6.71	.....	7.00	10.45	7.51	2.20	5.09
Total, station and switchyard	177.68	145.10	139.08	125.00	111.30	.....	103.00	133.24	122.66	97.40	175.10
COST OF ENERGY (Mills per net kwhr)											
Fixed charges	3.232	.....	3.134	3.727	0.59	4.52	2.25	3.29	2.90	.....	.....
Computed at (%)	12.5	.....	14.0	14.0	15.00	15.0	15.0	15.0	10.6	.....	.....
Operating charges	3.545	3.66	3.387	3.904	2.67	4.53	.48	42.9	1.97	2.208	3.015
Total	6.777	.....	6.521	7.631	3.26	9.05	3.73	7.58	4.87	.....	.....
STATION PERFORMANCE 1954											
Billion Btu used	16,004	7,656	11,338	10,439	6,033	9,745	12,430	11,448	7,450	8,931	5,498
Fuel cost (¢/million Btu)	27.8	30.86	29.75	26.54	20.07	33.4	11.4	31.8	13.54	7.48	23.2
Btu/net kwhr send out	10,580	9,922	9,582	11,119	10,742	11,330	11,040	11,783	11,386	13,245	10,753
Btu/gross kwhr generated	9,990	9,414	9,109	10,448	10,110	10,718	.....	11,197	10,615	12,353	10,029
Average boiler efficiency (%)	87.5	88.3	89.0	88.5	87.0	.....	85.2	89.81	83.4	82.9	.....
Station thermal eff, net (%)	32.26	34.3	35.6	30.7	31.8	30.1	.....	28.99	29.98	25.8	31.5
Employees per 1,000 kw per day	0.134	0.27	0.25	0.405	0.220	0.470	.....	0.531	0.203	0.560	0.493
Plant factor, annual (%)	78.6	74.0	67.5	70.5	34.4	52.5	74.6	69.3	50.1	37.0	77.8
Utilization factor, annual (%)	100.0	111.0	103.5	100.7	108.5	120.4	114.0	105.0	98.2	114.0	102.7

Additional Information (listed by station number):

256 Total number of employees includes 12 superintendents and 14 janitors.

257 Total number of employees includes one for supervision, 8 for technical positions, and 2 for office help.

259 Operating capability used.

264 Plant and utilization factors calculated on operating capability basis.

265 General data and investment details for latest extensions only. All other information for total plant.

266 All information except general data for second unit only.

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

* Rating groups (Manufacturer's Maximum Rated Capability), Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

** Electric plant account numbers prescribed by Federal Power Commission

Cost and Performance Data of 54 Modern Steam Stations

Station Number†	267	267(223)	269(180)	270	271(35)	272	273	274	275(176)	276	277
GENERAL DATA											
Year, first operation	1950	1951	1942	1952	1946	1953	1951	1953	1949	1949	1945
newest unit	1952	1954	1952	1953	1953	1953	1951	1953	1952	1952	1952
Total generator rating (MMRC)*	VI	VI	VI	VI	VI	VI	VI	V	V	V	V
No. of turbogenerators	2	3	4	3	2	1	1	2	2	4	3
Range of unit ratings*	IV	III		II-III	III-IV	VI	VI	III	III	I-III	II
No. of boilers	2	3	6	3	3	1	1	2	2	5	3
Range of ratings (M lb/hr)	575	450	125&310	320&425	250&650	825	656	425	400		230-325
Steam pressure (psi)	1,325	1,315	625&975	850&1,350	925&1,350	1,450	1,492	875	875		875
Stm temp, initial supht (F)	950	950	750&910	900&950	905&955	1,000	1,000	900	905		860&900
reheat (F)						1,000	1,000				
Cooling water range (F)	56-77	60-90	30-70	65-85	67-97	40-81	37-75	45-90	32-82	32-70	50-90
Corresponding vacuum (in. Hg)	.96-2.31	1.4-2.6	.8-1.3	1.25-2.25		.8-2.1	.46-1.52	.8-2.6	.54-2.6	.5-2.0	.8-2.7
Plant site area (acres)		117	42	35	22	21	63	353	53	67	145
In use (acres)		50	42	25	22	21	63	125	23	45	
Fuel storage, coal (tons)			100,000			40,000	650,000		125,000	200,000	
Oil (bbl)	16,054	135,000	228,000	240,000	110,000	52,000		216,000		110,000	20,000
Employees, total	44	62	61	48	60	65	18	61	67	63	58
Operation	18	41	54	32	36	17	8	42	50	54	47
Maintenance	22	18	7	10	20	25	10	9	6	8	10
Clerical, stores	2	1		2	4	7		2	2	1	1
Fuel handling				1		4		8	6		
Guards	2										
OUTPUT DATA											
Total gross gen (kwhr x 10^6)	776	876	361	807	678	742	559	448	673	505	651
Total net gen (kwhr x 10^6)	738	836	339	765	642	705	534	419	635	479	627
Maximum 1-hr peak (Mw)	136	151	112	118	131	115	102	98	107	98	86
Hours operation 1954		8,760	6,703	8,760	8,760	8,565	6,104	8,757	8,760	8,728	8,760
FUEL CONSUMPTION DATA											
Coal (tons)						118,167	194,753	190,331	299,947		
Btu/lb						13,479	13,176	12,600	12,020		
Ash (%), moisture (%)						7.5; 3.7	8.1; 5.5	12.5; 5.5	13; 8.5		
Cost (¢/million Btu)						36.27	30.71	26.20	29.62		
Oil (bbl)	420,490	1,451,400	719,931	54,265	1,159,836	601,390			11,198	790,060	
Btu/gal	151,667	150,900	151,477	153,000	150,790	149,790			137,900	150,850	
Cost (¢/million Btu)	32.10	32.09	34.00	32.00	32.40	34.96			76.24	34.40	
Gas (M cu ft)	5,173,232			7,581,877							8,039,472
Btu/cu ft	1,115			1,118							1,000
Cost (¢/million Btu)	18.00			24.85							13.49

Station Number†	267	268(223)	269(180)	270	271(35)	272	273	274	275(176)	276	277
OPERATING COSTS (Mills per net kwhr)											
Fuel	2.57	3.504	4.61	2.970	3.71	3.566	2.970	3.00	3.44	3.59	1.73
Wages (incl supervision)	0.29	0.282	0.76	0.243	0.36	0.279	0.318	0.52	0.47	0.46	0.39
Water, lubrication, supplies	0.04	0.030	0.03	0.085	0.04	0.065	0.038	0.09	0.06	0.07	0.03
Maintenance	0.30	0.202	0.17	0.138	0.22	0.150	0.456	0.23	0.28	0.95	0.17
Total, oper & mtce (excl fuel)	0.63	0.514	0.96	0.466	0.62	0.494	0.811	0.84	0.81	1.48	0.59
Total operation (incl fuel)	3.20	4.018	5.57	3.436	4.33	4.060	3.781	3.84	4.25	5.07	2.32
INVESTMENT DATA (Dollars per kw)											
**(310) Land	0.16	0.20	0.53	1.31	1.40	4.56	.....	0.45	3.95	0.82	0.23
(311) Structures, improvements	19.58	32.00	46.70	7.98	25.30	56.03	21.29	38.93	44.99	57.89	20.38
(312) Boiler plant equipment	42.17	53.30	56.04	40.91	47.70	78.20	42.84	59.40	66.52	100.59	32.44
(314) Turbogenerator unit	36.17	51.40	46.39	58.24	31.82	43.41	34.77	50.18	40.53	46.75	35.30
(315) Accessory elec equipment	8.31	15.00	.....	11.21	8.99	17.56	4.81	12.72	18.09	13.04	8.04
(316) Misc plant equipment	0.45	0.75	0.92	0.65	1.40	0.99	0.93	1.59	2.68	3.35	0.81
Total station	106.84	152.65	150.58	120.30	116.61	200.75	104.14	163.26	176.76	222.44	97.19
Outdoor switchyard	11.56	9.00	8.28	9.79	.....	11.01	6.81	8.91	.....	14.22	7.74
Total, station and switchyard	118.40	161.65	158.86	130.09	.....	211.76	110.95	172.17	176.76	236.66	104.93
COST OF ENERGY (Mills per net kwhr)											
Fixed charges	2.83	.....	6.99	2.578	2.99	4.81	2.88	.....	4.54	6.11	.....
Computed at (%)	11.1	.....	13.1	6.0	15.0	16.0	14.0	.....	17.0	14.77	.....
Operating charges	3.20	4.018	5.57	3.436	4.33	4.06	3.781	3.84	4.25	5.07	2.32
Total	6.03	.....	12.56	6.014	7.32	8.87	6.661	.....	8.79	11.18	.....
STATION PERFORMANCE 1954											
Billion Btu used	8,445	9,185	4,580	8,825	7,345	6,971	5,264	4,788	7,276	5,005	8,039
Fuel cost (¢/million Btu)	22.49	32.09	34.00	25.13	32.4	36.04	30.71	26.27	30.04	34.40	13.49
Btu/net kwhr send out	11,448	10,971	13,503	11,780	11,435	9,894	9,858	11,420	11,459	10,445	12,818
Btu/gross kwhr generated	10,880	10,490	12,682	11,160	10,829	9,388	9,416	10,690	10,803	9,908	12,341
Average boiler efficiency (%)	85.64	88.5	85.0	86.0	87.9	88.0	89.0	89.0	.....	85.0	82.1
Station thermal eff, net (%)	29.81	32.6	26.0	29.0	29.8	34.5	34.6	29.9	29.78	32.7	26.6
Employees per 1,000 kw per day	0.360	0.490	0.390	0.273	0.510	0.420	0.180	0.410	0.330	0.700	0.410
Plant factor, annual (%)	70.9	83.3	36.0	83.8	70.6	69.9	60.9	58.0	80.1	64.7	90.0
Utilization factor, annual (%)	108.8	125.7	98.0	107.3	119.4	100.0	102.0	111.0	111.5	109.7	104.0

Additional Information (listed by station number):
267 One unit operated 7,165 hr, the other 8,154 hr.
268 Station use below normal because of increased use of hydro power.
272 Total number of employees includes 12 superintendents.
275 Investment for outdoor switchyard included in Accessory Electrical Equipment Account (315)
† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

* Rating Groups (Manufacturer's Maximum Rated Capability), Mw. I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.
** Electric plant account numbers prescribed by Federal Power Commission.

Cost and Performance Data of 54 Modern Steam Stations

Station Number†	278	279	280	281	282	283	284	285	286	287
GENERAL DATA										
Year, first operation	1953	1953	1950	1954	1953	1953	1954	1949	1953	1950
newest unit	1953	1953	1951	1954	1953	1953	1954	1949	1953	1950
Total generator rating (MMRC)*	V	V	V	IV	IV	IV	II	II	II	II
No. of turbogenerators	1	1	3	1	1	1	1	1	1	2
Range of unit ratings*	V	V	II	IV	IV	IV	II	II	II	I
No. of boilers	1	1	3	1	1	1	1	1	1	2
Range of ratings (M lb/hr)	750	775	270	630	630	475	375	285	300	150
Steam pressure (psi)	1,350	1,350	900	850	950	1,700	900	900	900	650
Stm temp, initial supht (F)	955	955	900	900	910	1,000	900	900	361	835
reheat (F)	.....	.....	.....	.....	.....	1,000	.....	.....	.....	.....
Cooling water range (F)	48–88	75–95	55–95	50–90	44–93	32–80	55–95	32–100	40–85	45–94
Corresponding vacuum (in. Hg)	.95–2.17	1.0–3.1	1.25–2.75	.7–2.0	.67–3.22	.02–1.55	1.25–2.75	.75–3.25	.33–1.66	.7–3.5
Plant site area (acres)	2,200	280	262	102	60	51	74	186	138	5,800
In use (acres)	.....	280	83	50	10	16	74	57	.....	5,800
Fuel storage, coal (tons)	.....	.....	.....	.....	.....	17,500	125,000	100,000	10,500	.....
Oil (bbl)	12,000	60,000	55,000	20,000	20,000	38,300	24,000	55,000	.....	61,000
Employees, total	37	48	37	28	32	120	42	84	23	72
Operation	18	26	21	16	16	74	24	45	17	39
Maintenance	6	14	12	11	10	46	12	26	4	23
Clerical, stores	2	3	1	1	2	.....	1	4	1	3
Fuel handling	.....	.....	.....	.....	.....	.....	5	5	.....	.....
Guards	5	5	.....	.....	.....	.....	.....	.....	1	7
OUTPUT DATA										
Total gross gen (kwhr x 10^6)	520	533	477	198	553	410	233	240	180	763
Total net gen (kwhr x 10^6)	493	503	449	182	525	383	215	228	173	728
Maximum 1-hr peak (Mw)	89	95	76	76	80	67	37	33	37	175
Hours operation 1954	7,599	8,110	8,760	5,861	7,971	6,868	8,760	8,760	8,531	8,760
FUEL CONSUMPTION DATA										
Coal (tons)	.....	.....	.....	.....	.....	180,000	25,894	31,607	.....	.....
Btu/lb	.....	.....	.....	.....	.....	13,000	11,500	11,500	.....	.....
Ash (%), moisture (%)	.....	.....	.....	.....	.....	11; 6	11.1; 8.9	11.1; 8.9	.....	.....
Cost (¢/million Btu)	.....	.....	.....	.....	.....	30.00	30.80	30.30	.....	.....
Oil (bbl)	461	1,611	.....	.....	7	.....	2,400	2,400	.....	2,969
Btu/gal	150,060	146,071	.....	.....	156,880	.....	144,500	148,200	.....	146,071
Cost (¢/million Btu)	47.48	44.35	.....	.....	23.80	.....	30.40	30.10	.....	44.25
Gas (M cu ft)	5,222,529	5,430,218	5,666,370	2,115,430	5,359,896	.....	2,100,000	2,110,000	1,790,064	8,804,460
Btu/cu ft	1,099	1,070	1,011	1,034	1,171	.....	1,025	1,025	1,133	1,067
Cost (¢/million Btu)	11.90	7.80	17.56	16.06	13.40	.....	17.55	17.55	13.82	7.20

Station Number†	278	279	280	281	282	283	284	285	286	287
OPERATING COSTS (Mills per net kwhr)										
Fuel	1.38	0.912	2.24	2.09	1.60	3.10	2.65	2.65	1.62	0.94
Wages (incl supervision)	.....	0.343	0.31	.....	0.20	.....	0.64	0.66	0.42	0.43
Water, lubrication, supplies	.....	0.045	0.04	0.55	0.10	.....	0.08	0.04	0.18	0.05
Maintenance	.....	0.238	0.04	0.13	0.30	.....	0.13	0.19	0.18	0.58
Total, oper & mtce (excl fuel)	0.46	0.626	0.39	0.68	0.60	.....	0.85	0.89	0.78	1.06
Total operation (incl fuel)	1.84	1.538	2.63	2.77	2.20	.....	3.50	3.54	2.40	1.99
INVESTMENT DATA (Dollars per kw)										
**(310) Land	4.44	.....	0.79	1.19	0.89	.....	.....	.....	0.77	.....
(311) Structure; improvements	33.70	21.65	22.98	16.53	20.98	48.52	.....	.....	23.48	23.90
(312) Boiler plant equipment	38.85	38.73	34.58	32.46	51.37	72.70	.....	.....	35.64	50.40
(314) Turbogenerator unit	33.20	36.12	46.60	45.53	48.14	52.75	.....	.....	51.72	44.70
(315) Accessory elec equipment	10.60	7.04	8.14	9.91	11.33	16.20	.....	.....	8.75	12.50
(316) Misc plant equipment	1.07	0.93	0.48	3.35	2.38	3.54	.....	.....	2.89	0.30
Total station	121.86	104.47	113.57	108.98	135.09	193.71	.....	.....	123.25	131.80
Outdoor switchyard	12.00	6.60	12.70	28.31	10.24	5.02	.....	.....	9.83	12.70
Total, station and switchyard	133.86	111.07	126.27	137.29	145.33	198.73	.....	.....	133.08	144.50
COST OF ENERGY (Mills per net kwhr)										
Fixed charges	3.02	.....	.....	2.91	2.00	.....	.....	.....	1.47	.....
Computed at (%)	13.5	.....	.....	8.33	12.25	.....	.....	.....	5.76	.....
Operating charges	1.84	1.538	2.63	2.77	2.20	.....	3.50	3.54	2.40	1.99
Total	4.86	.....	.....	5.68	4.20	.....	.....	.....	3.87	.....
STATION PERFORMANCE 1954										
Billion Btu used	5,748	5,823	5,725	2,206	6,317	4,680	2,760	2,920	2,029	9,411
Fuel cost (¢/million Btu)	12.04	7.88	17.56	16.06	13.40	30.00	20.5	20.65	13.82	7.27
Btu/net kwhr send out	11,667	11,581	12,749	12,117	11,947	10,632	12,800	12,800	11,759	12,926
Btu/gross kwhr generated	11,065	10,921	12,000	11,163	11,358	9,975	12,000	12,190	11,254	12,327
Average boiler efficiency (%)	82.9	84.2	83.0	86.3	85.0	88.1	84.0	84.0	82.6	83.8
Station thermal eff, net (%)	.....	29.5	26.8	28.2	28.57	34.2	26.6	26.6	29.7	26.4
Employees per 1,000 kw per day	0.320	0.620	0.200	0.230	0.280	.....	0.400	0.340	0.697	0.410
Plant factor, annual (%)	64.7	75.6	70.7	38.6	99.7	76.7	74.0	78.8	70.47	59.0
Utilization factor, annual (%)	102.3	112.0	98.8	115.2	121.2	107.2	100.0	100.0	112.1	122.0

Additional Information (listed by station number):
278 Plant acreage includes area of a lake.
279 Plant acreage includes area of storage pond and impounding basin.
283 Employees total include men for older plant section.
287 General data and investment details for latest extensions only. All other information for total plant.

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

* Rating groups (Manufacturer's Maximum Rated Capability) Mw: I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.
** Electric plant account numbers prescribed by Federal Power Commission

Power Plant Space Factors

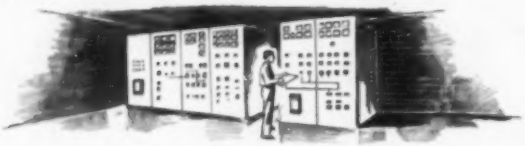
BOILER ROOM (CU FT/KW)

Mw Range	Max	Min	Avr
20–39	34.80	2.90	.....
60–74	15.00	2.60	.....
75–99	22.20	3.56	14.31
100–149	19.70	4.31	11.51
150–299	25.01	4.80	14.44
300–499	14.25	9.30	12.75
500 & up	14.56	11.59	12.77

TURBINE ROOM (CU FT/KW)

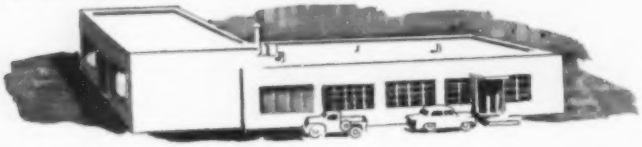
Mw Range	Max	Min	Avr
20–39	12.80	12.40	12.60
60–74	6.80	4.40	5.40
75–99	13.07	7.33	9.96
100–149	12.50	1.59	7.31
150–299	13.00	6.70	8.53
300–499	10.50	6.73	6.78
500 & up	10.97	7.05	7.73

SWITCHHOUSE (CU FT/KW)



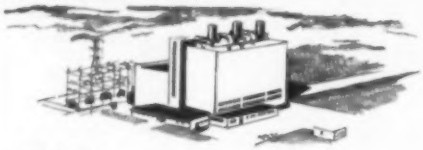
Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	0.50	0.40	0.45
75–99	0.80	0.15	0.46
100–149	0.96	0.09	0.39
150–299	4.57	0.07	1.09
300–499	2.00	0.30	0.54
500 & up	0.37	0.09	0.32

OFFICE (CU FT/KW)



Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	1.06	0.29	0.68
75–99	2.00	0.21	0.55
100–149	2.87	0.17	0.42
150–299	1.92	0.14	0.81
300–499	1.54	0.20	0.86
500 & up	1.79	0.19	0.64

BUILDING, GROUND AREA (SQ FT/KW)



Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	0.26	0.23	0.25
75–99	0.41	0.29	0.36
100–149	6.52	0.14	0.30
150–299	0.58	0.15	0.29
300–499	0.30	0.18	0.25
500 & up	0.35	0.13	0.19

SWITCHYARD (SQ FT/KW)

Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	.....	.....	.....
75–99	0.93	0.60	0.80
100–149	1.08	0.12	0.39
150–299	0.55	0.19	0.38
300–499	0.47	0.15	0.33
500 & up	1.07	0.15	0.48

FUEL STORAGE AREA (SQ FT/KW)

Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	.....	.....	.....
75–99	.....	.....	.....
100–149	0.78	2.70	1.21
150–299	0.41	2.87	1.09
300–499	0.51	1.47	0.97
500 & up	2.83	1.01	1.70

COAL STORAGE (TONS/KW)

Mw Range	Max	Min	Avr
20–39	.....	.....	.....
60–74	.....	.....	.....
75–99	.....	.....	.....
100–149	1.63	0.41	0.83
150–299	2.60	0.90	1.31
300–499	1.65	0.68	1.04
500 & up	2.88	0.62	0.71

165 MVA? 300 MVA? 500 MVA?

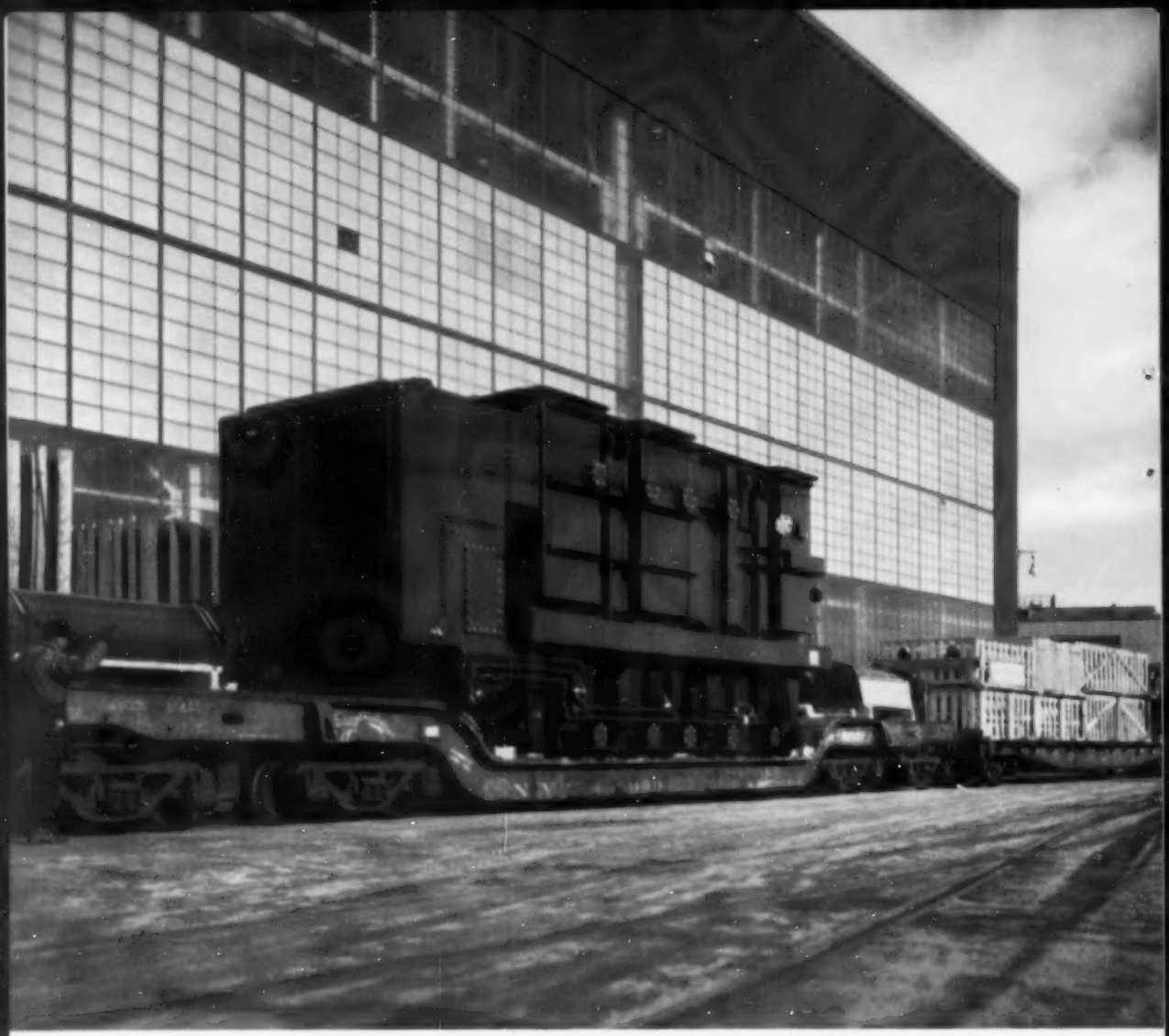
This transformer is rated 300,000 kva, 161 kv, the highest capacity unit shipped to the industry at this writing. Only seven years ago the maximum capacity we could build into a tank this size would have been 165,000 kva. Today we can build a transformer of 500,000 kva small enough to be transported and installed economically.

Research makes transformers like this possible: research in core steel, insulation, winding configuration and cooling. Modern tools such as electronic calculators, electromagnetic models, and the sound laboratory assist by making new data available with unbelievable speed and accuracy. At General Electric the results of this research make higher capacity, higher voltage transformers available when you need them.

Power Transformer NEWS

Progress Is Our Most Important Product

GENERAL ELECTRIC

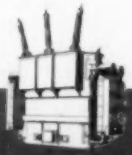


$2700 GRAVY TRAIN

This 330 kv, 100 mva G-E transformer was delivered with a $2700 dividend. It cost that much less to install than another unit having the same rating, delivered to the same site, but made by a different manufacturer. There is no secret reason.

The G-E transformer was shipped in a completed one-piece tank, requiring no welding in the field. The load tap changer compartment was factory assembled, installed and wired, except for the motor drive. All external wiring was pre-cut to the proper length and fitted with terminals.

These are a few of the reasons why important savings are being realized by utilities who factor in the cost of installation along with the purchase price. Are you getting these savings for your company? General Electric Company, Schenectady 5, N. Y. 421-35



Power Transformer NEWS

Progress Is Our Most Important Product

GENERAL ELECTRIC

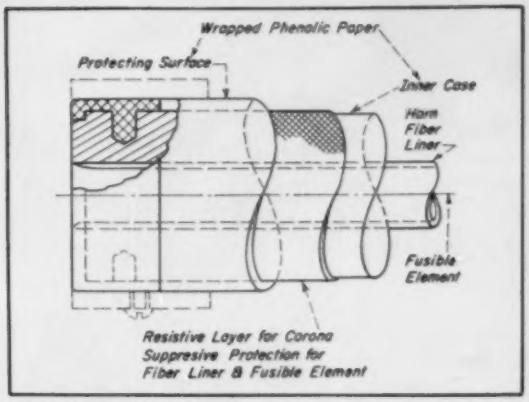

Wrapped Phenolic Paper
Protecting Surface
Inner Case
Horn Fiber Liner
Fusible Element
Resistive Layer for Corona Suppresive Protection for Fiber Liner & Fusible Element

FIG 1—SHIELDED FUSE TUBE has high-resistance layer that connects to both end terminals of the fuse element

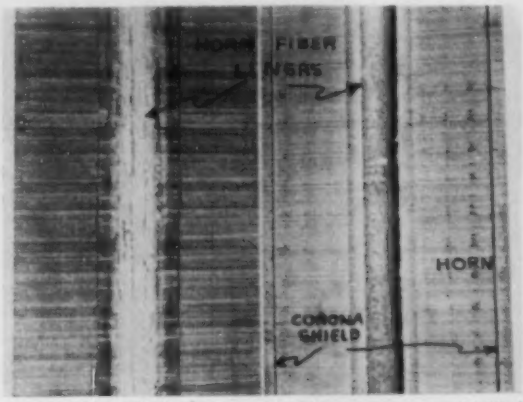


FIG 2—TEST RESULTS reveal deterioration of nonshielded tube (left) and good condition of corona shielded tube (right)

SUBSTATIONS—Design

Shielding in Fuse Tube Improves Service Life

High-resistance shield in open-type fuse tubes, used with expulsion-type fuses on lines above 15 kv, limits corona-produced acid that corrodes fuse links

W. H. McCLURE, Supervisor of Substations, Alabama Power Co, Birmingham, Ala.

Open-type fuse tubes with corona shields are being used by Alabama Power Co. in expulsion-type fuses on lines above 15 kv to reduce the fuse failures caused by corona-produced nitrous acid. Experience to date shows that the service life of the fuse links in shielded tubes is over three times greater.

Development of the shielded tube, which was instigated by the company, stems from deterioration of the fuse links. Nitrous acid, a very destructive chemical that is produced by corona associated with moisture, was corroding the fuse elements, causing them to break in two.

Resulting interruptions were reduced by a costly and frequent replacement program. But even when a reasonable care was applied to scheduling replacements, outages still continued. Improper operations also resulted because a deteriorated fuse element would not coordinate with other protective devices.

Second only in importance to the deterioration of fuse links was the actual destruction of the fuse tubes in expulsion fuses by the corona-produced acid.

To eliminate these ill effects of corona a fuse tube with a high-resistance, or semi-conducting, shield was made by hand. The model was tested under actual service conditions but at 110 kv and with a small fuse element to accelerate deterioration. Results were so satisfactory that similar tubes were produced commercially.

The shielded tube looks like a conventional one but has a high-resistance material connected to both end terminals of the fuse, Fig. 1. In this manner the voltage gradient between the shield and fuse link is reduced below the critical corona-producing voltage.

Field tests of these tubes in expulsion fuses were again made at 110 kv with small-size fusible elements that had been treated with neoprene and varnish. After six-months service, Fig. 2, the horn fiber liner of the nonshielded tube was in an advanced state of deterioration. The shielded tube, on the other hand, was in perfect condition.

Fuse links in the nonshielded tubes,

(*Continued on page 152*)

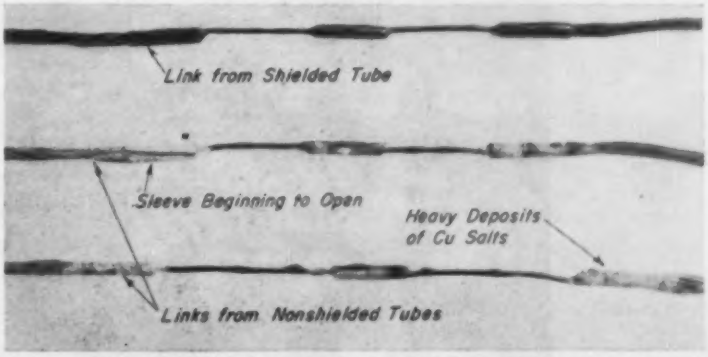
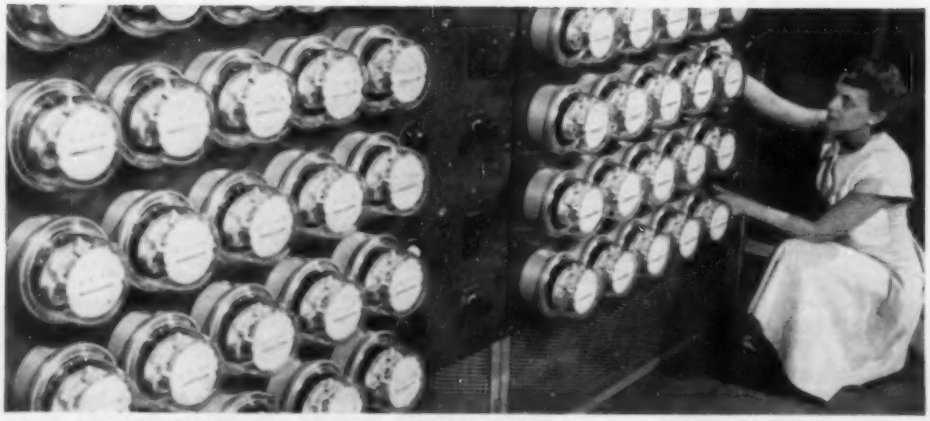


FIG 3—AFTER SIX MONTHS of testing the fuse link from shielded tube (top) was in good condition compared with the corroded links from nonshielded tubes

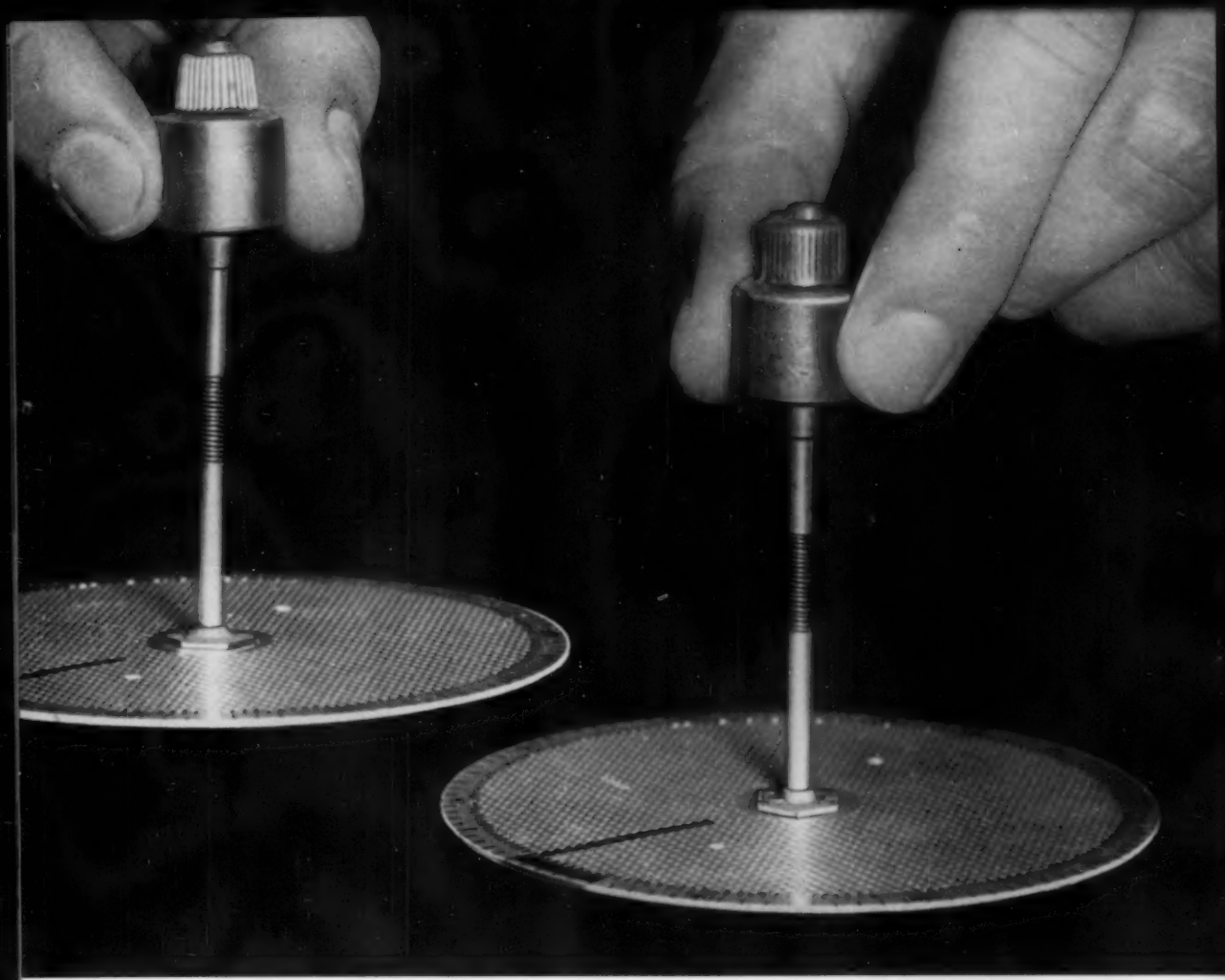
Adapted from a paper presented at the Southeastern Electric Exchange Engineering & Operation Section meeting in New Orleans.

AFTER 250 MILLION DISK REVOLUTIONS, or an equivalent of more than 300 years of meter operation, life tests show no bearing wear in General Electric's magnetic suspension system.

Life Tests Prove...



LABORATORY RUNNING TESTS on sample lots of General Electric's I-50 meter family serve as additional checks on over-all meter performance and the lifetime characteristics of the magnetic suspension system.



No Bearing Wear

A true lifetime bearing system, already having registered the equivalent of more than 300 years' use under normal operating conditions, is now assured with all members of General Electric's I-50 meter family. Results from continuing accelerated life tests, conducted in General Electric research laboratories, prove that the revolutionary magnetic suspension system eliminates the need for bearing replacement.

These General Electric meters have registered more than 250 million revolutions of the floating disk. This is equal to over 300 years of meter operation at the national average load of 3000 KWH annually. Results show no measurable wear on the graphite washer or guide pin in G.E.'s magnetic suspension system.

These tests substantiate the perfect record of the magnetic suspension system in the more than 6,000,000 I-50 meters in service today. They offer proof that G.E.'s meter family—by eliminating bearing maintenance and replacement expenses—assures you of lower metering costs. For more information contact your nearest G-E Apparatus Sales Office or write General Electric Company, Section 621-4, Schenectady 5, N. Y.

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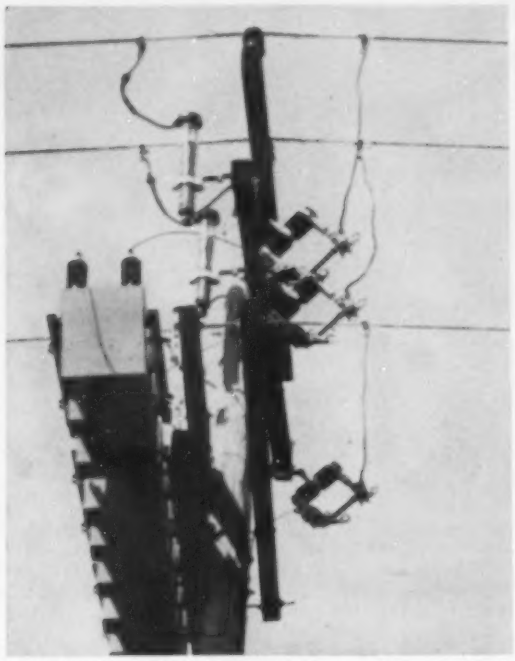
Shielded Fuse Tube

(*Continued from page* 149)

Fig. 3, were badly corroded and no longer dependable. They could not be expected to coordinate with other fuses or breakers. However, the link in the shielded tube was as good as new.

Tests on the link in the shielded tube will be continued, and checks will be made periodically. The 18-month check, just completed, revealed that the link was in the same good condition.

From these tests Alabama Power has proven that service life of the fuse links and tubes can be tripled and expects that the life can be further multiplied. Therefore, the company is using the corona-shielded tubes on all new installations of expulsion fuses, 22 kv and above, and is replacing all non-shielded tubes when found deteriorated. This program will eliminate unnecessary interruption and associated unfavorable customer relations and lost revenue.



LOAD-BREAK CUTOUTS are installed on new capacitor banks of 90 kvar or more, like this 225-kvar installation

CAPACITOR INSTALLATION FUSING SCHEDULE

Bank Kvar	Size Links in Amps: Single Phase, Phase to Ground, Delta, 2.4 Kv	Single Phase, Phase to Ground, Wye, 2.4 Kv	Single Phase, Phase to Ground, Wye, 7.2 Kv / 7.6 Kv	Three Phase, Phase to Phase, *Delta, 2.4 Kv	Three Phase, Phase to Phase, Wye, 4.16 Kv	Three Phase, Phase to Phase, Wye, 12.54 Kv / 13.2 Kv
15 Kvar Units						
15	15	15	5	——	——	——
30	25	25	7	——	——	——
45	——	——	10	20	15	5
90	——	——	——	40	25	7**
135	——	——	——	60	40	10**
180	——	——	——	75	50	15**
25 Kvar Units						
25	20	20	7	——	——	——
50	40	40	15	——	——	——
75	——	——	25	30	20	7
150	——	——	——	60	40	15**
225	——	——	——	75	60	25**
300	——	——	——	——	——	40**

*—Size of links based on fusing on line outside the delta.
**—On manually switched banks over 90 kvars use load-break cutouts to deenergize bank.

Load-Break Cutouts Switch Capacitor Banks

W. E. SHAFER, Overhead Engineer, Virginia Electric & Power Co, Richmond, Va.

Load-break cutouts are being used by Virginia Electric & Power Co to switch and protect distribution capacitor banks. Operating experience has been so good that the cutouts are also being used for other purposes. The cutouts eliminate the need for combination fuses and load-interrupting switches which are more costly and sometimes inconvenient to install.

To determine their feasibility and application, 7.8-kv loadbreak cutouts from two manufacturers were tested by interrupting current of capacitor banks. Banks of 180 and 300 kvar were connected through the cutouts to 2.4, 7.2, and 12-kv lines.

Because of the excellent test results, the company changed its schedule tables for capacitor fusing. Now new installations of bank of 90 kvar and larger on 12-kv circuits are protected and switched with the new load-break cutouts.

Experience shows that cutouts should have:

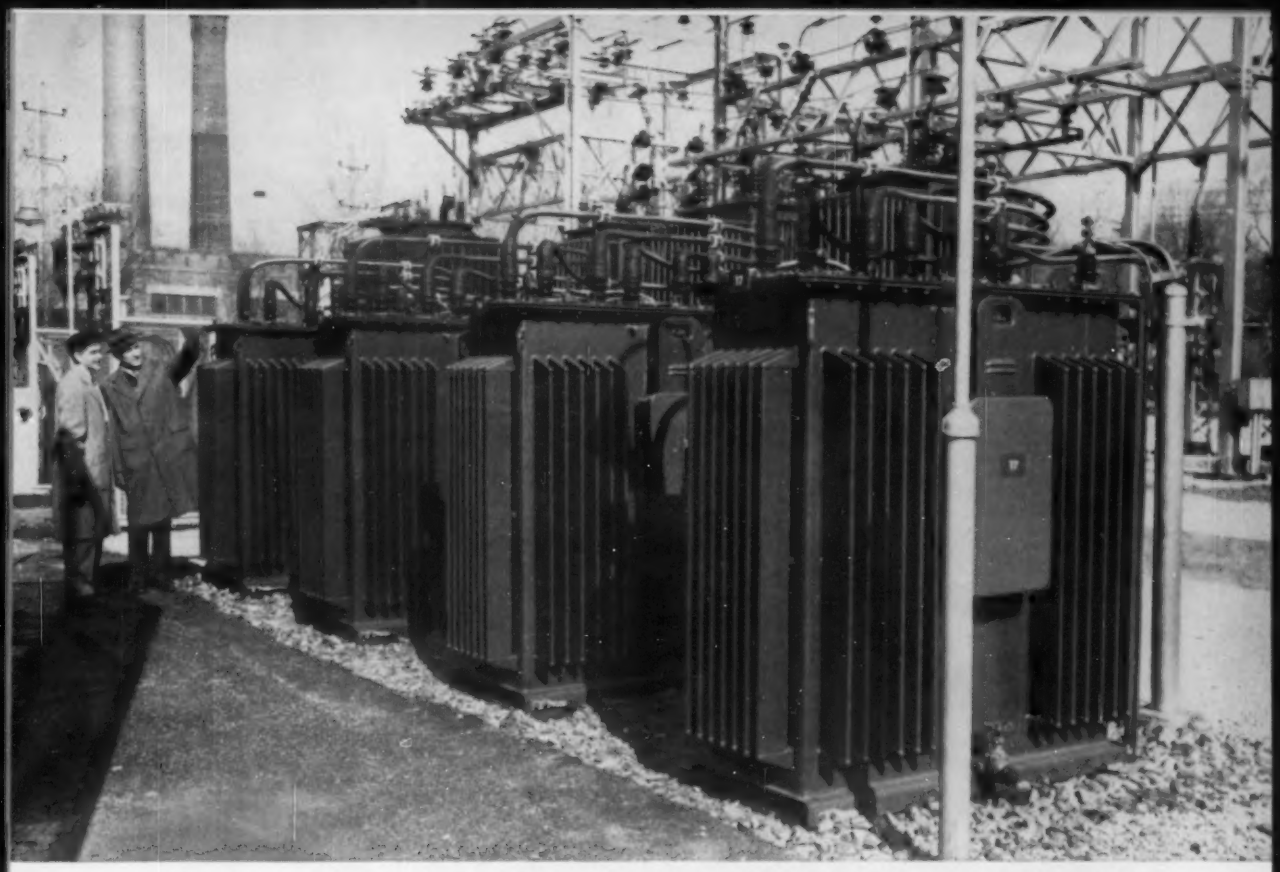
1. The lever arm pointing towards the pole to facilitate covering with a rubber blanket, for hot-line work on 5 kv and below.

2. A lever arm capable of breaking the strain wire of a 100-amp fuse link inside of the tube to confine the arc and prevent hot metal from dropping on linemen.

3. An open eye on top of the fuse tube to prevent opening the cutout in the conventional manner.

The load-break cutouts have performed very well on capacitor installations. For this reason the company plans to expand their use for the following purposes: Breaking line charging current, disconnecting industrial substations, and disconnecting OH and UG primary services to customers having large transformer banks.

(*More How To on page* 158)



G.E.'s 3-phase induction voltage regulators give dependable service at Philadelphia Electric Company's Overbrook Substation.

FOR LOWER OPERATING COSTS . . .

G-E 3-phase, triplex, induction regulators save space and reduce maintenance expense

Overbrook is one of Philadelphia Electric Company's substations in an outlying residential and industrial area. Originally a two-phase station, it now serves this area with nominal 4000-volt, three-phase, 300-amp feeders. The new feeders are provided with three-phase induction voltage regulators for ±10 per cent regulation.

Lowered cost of maintenance, as well as rapid voltage response to the varying demands of the important loads they serve, is inherent in these units. In addition, space was saved at Overbrook by using induction-type units, eight of which are installed at this station. Each of these was readily fitted into the position formerly occupied by two single-phase, induction-type, feeder voltage regulators on the old two-phase feeders.

You, too, will find General Electric's three-phase, triplex, induction regulators excellent for the closest regulation of your feeders.

They are especially useful where voltage swings require immediate correction and operations are frequent.

Their sturdy, long-lived operating mechanism—with no switching contacts—requires no maintenance. This elimination of routine internal maintenance results in lower servicing costs.

For more information, get in touch with your nearest G-E Apparatus Sales Representative or write: General Electric Co., Schenectady 5, New York. 423-9

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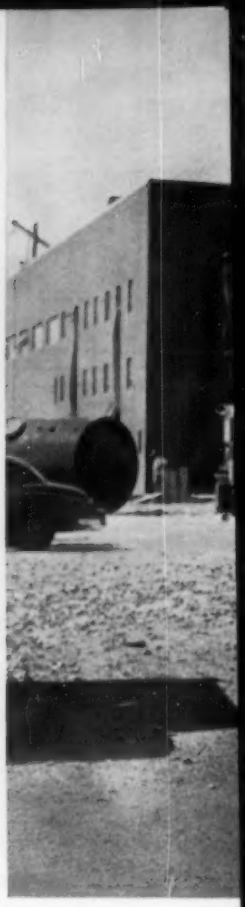


MUSHROOMING LOADS like this all-air-conditioned department store at a new Levittown shopping center have created a load growth problem for the Long Island Lighting Company.

How Long Island Lighting Pares Cost of Future Secondary Network System

TREMENDOUS EXPANSION of both residential and commercial building load on Long Island makes it necessary to plan far ahead. A secondary network seems to be inevitable in some of the newer commercial areas serviced by the Long Island Lighting Company of Mineola, N. Y. Recognizing this problem, Long Island Lighting is already planning on how to cut costs of its *future* network system.

Even though new areas are still served by a radial system, the utility is installing G-E *network* transformers to handle concentrated loads in new shopping centers, like the all-air-conditioned department store at Levittown. When a secondary network becomes necessary, many of the vaults will already be equipped with network transformers and only network protectors will have to be added . . . giving a considerable saving on ultimate installation and rearrangement.

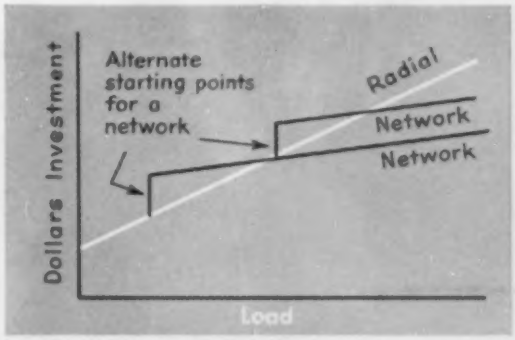
OTHER BENEFITS come from this advanced planning. Congested overhead wiring is eliminated. Better service continuity results from underground service. Greater dependability is obtained from submersible G-E network transformers . . . with their new panel-type radiators that minimize corrosion and facilitate maintenance, and particularly cleaning and repainting.

HELP FOR YOUR SYSTEM. If you are planning to meet continued load growth with a radial system and your load density can be expected to reach 50 to 100 kva per 100 feet of street within the next ten to fifteen years, now is the time to investigate the advantages of a secondary network.

G-E district engineers will be glad to help you compare the costs of your present system and the potential savings possible with a network. For full details, write to Section 435-9, for Bulletin GET-2432. General Electric Company, Schenectady 5, N. Y.

FUTURE CONVERSION TO NETWORK SYSTEM is facilitated by the installation of this G-E network transformer with "panel-type" radiators. When the secondary network system becomes a reality, the only additional equipment necessary will be the installation of network protectors.

PLACED IN AN HOUR under the shopping-center parking lot, this 1000-kva 13,200–216Y/125 unit can weather submersion if lot should become flooded.



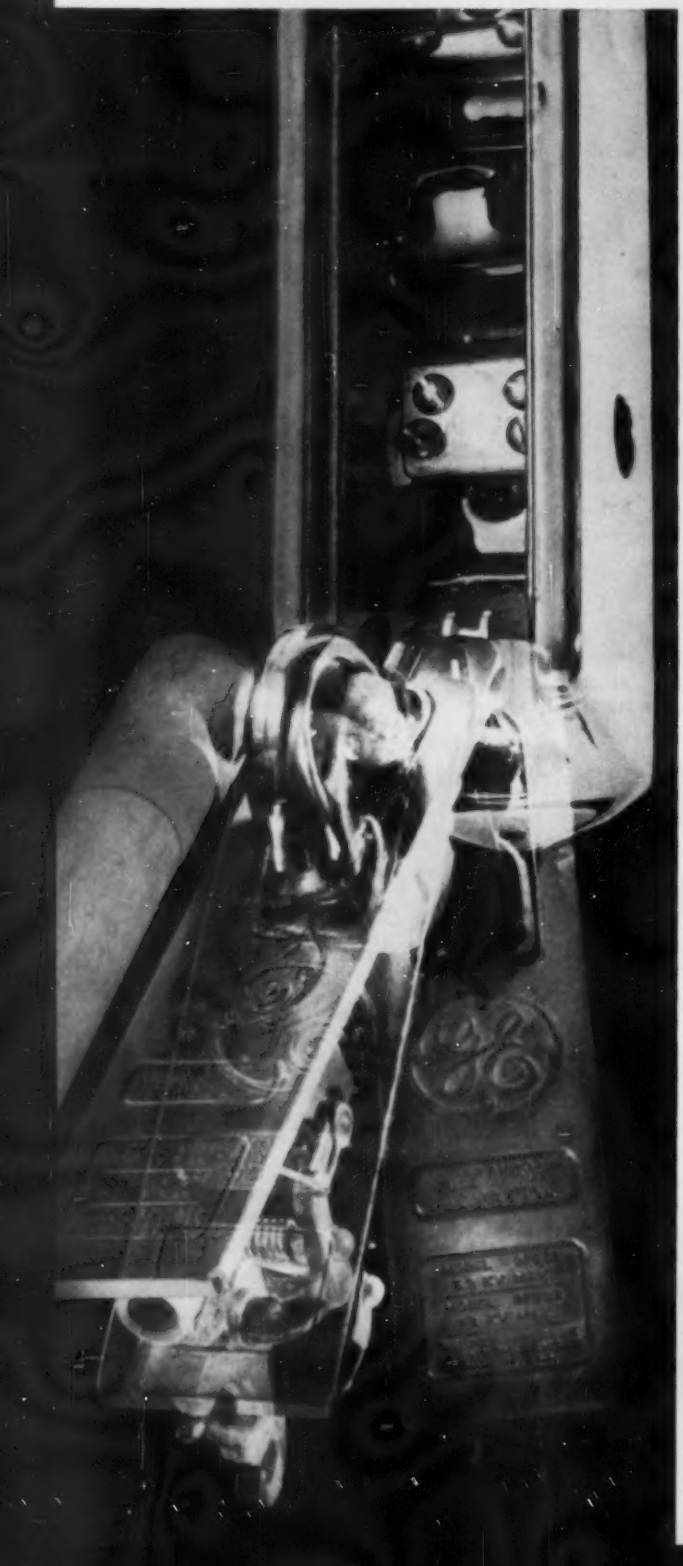
IT PAYS TO START A NETWORK. Future increases in capacity require less investment with a network. The sooner it is started, the lower the ultimate cost.

Progress Is Our Most Important Product

GENERAL ELECTRIC

old

Door could wiggle, swing around, sometimes even fall off the stick. Dangerous and aggravating.



new

Stick fits securely in door socket. Door stays steady. No juggling, faster replacement.

ALL-NEW ENCLOSED FUSE CUTOUTS

now...

socket-grip door handle on new G-E fuse cutout ends switchstick juggling

Now every door on G.E.'s new cutout line has a new design idea—a socket-grip handle that fits snugly over the head of a conventional switchstick for easy door removal or replacement.

It's a G.E. "first". Your lineman shoves the stick in the door socket, lifts up to the housing, and hooks the door hinge on. He hits it right—the first time. The socket-grip door handle also provides a secure hold for a gloved hand.

DOORS ON G.E.'S NEW CUTOUTS have plenty of other advantages—they're easier to connect, easier to fuse, easier to close and open. Disconnect blades are hinged, and can't fall to the ground accidentally. With the unique G-E convertible door, cutouts are easily converted in seconds from indicating non-dropout to dropout.

4 DOORS—1 HOUSING—that's all you need with G.E.'s new simplified fuse cutout line. You get all cutout functions—indicating-dropout, indicating-non-dropout, and disconnect. Two current ratings are available—50 amp. and 100 amp., and two voltage ratings—5.2 and 7.8 kv.

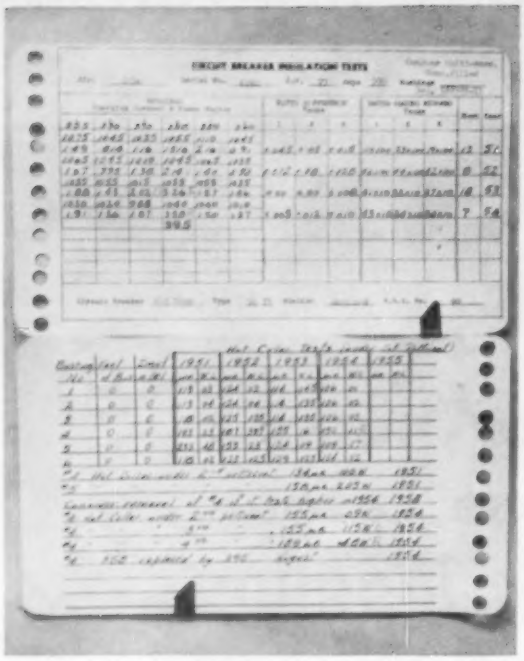
ENGINEERS AND LINEMEN WILL LIKE these other new features in the G-E cutout line: plastic-to-metal latching that prevents door "freezing" . . . the rugged hanger support that withstands the roughest shocks encountered in service . . . flip-out semaphore that gives easy-to-see evidence of a blown fuse. These features are now standard in all new G-E cutouts. Learn all about it—write for Bulletin GEA-6208, General Electric Company, Section 433-10, Schenectady 5, N. Y.

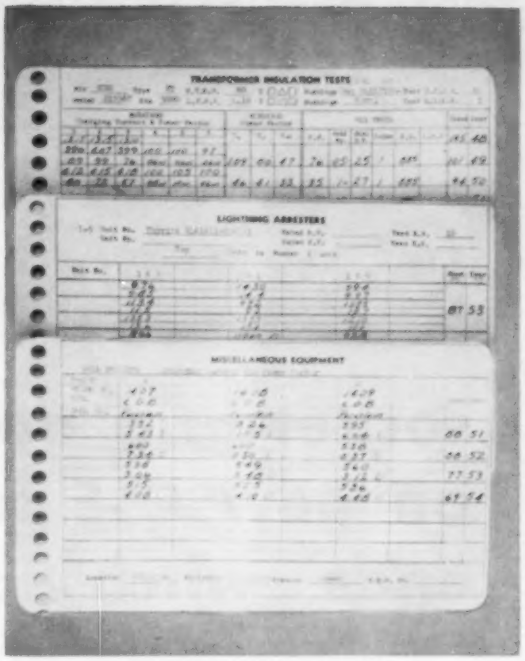
ENGINEERS AND LINEMEN AGREE

The completely new line of G-E fuse cutouts has more of the features they prefer. There's good reason, too—the new design incorporates suggestions made by utility engineers and linemen to G-E sales engineers and specialists.

Progress Is Our Most Important Product

GENERAL ELECTRIC





Four test sheets of different colors are fastened in a binder so that . . .

Record System Summarizes Insulation Data

L. A. BATEMAN, Supt of Production,
J. W. BREED, Maintenance Engineer, City of Winnipeg Hydro-Electric System, Winnipeg, Manitoba, Canada

A new record system for summarizing insulation test data has been set up by the City of Winnipeg Hydro-Electric System to increase the efficiency of the annual insulation test program. The system consists of a special sheet for each piece of equipment, indexed by substations and circuits in a ring binder.

During the first year of use the summary book saved many hours of both field and office work. Moreover, it shows at a glance the insulation trends for equipment and is compact, light weight, rugged, and flexible.

Heart of the system is four types of data sheets—one each for transformers, circuit breakers, lightning arresters, and miscellaneous equipment. For easy identification each type is a different color, either white, yellow, pink, or green. All measure 5 x 8½ in.

The sheets are fastened in a 20-ring binder that measures 3½ x 11 x 16 in. and has a ¼-in. thick cover. They are placed one on top of another with only the bottom line of each showing. At present 14 sheets make a layer, or page, but this can be increased to 27 by reducing the bottom margin.

Each layer is separated by a division sheet having an index tab protruding from the edge. The book has a capacity for 46 such layers, or a total of 1,242 insulation data sheets.

Bottom index lines on the summary data sheets contain all the information required to locate a piece of equipment. At the top of the sheet is information for completing the heading of a field data sheet.

Charging current and power factor of any bushing on a transformer or breaker are recorded, one over the other, under the bushing position number. If only a hot-collar test is made, a "W" beside the watts differentiates the values from a hot-guard test. The grade of each value other than "Good" is entered in red to point out deteriorated equipment.

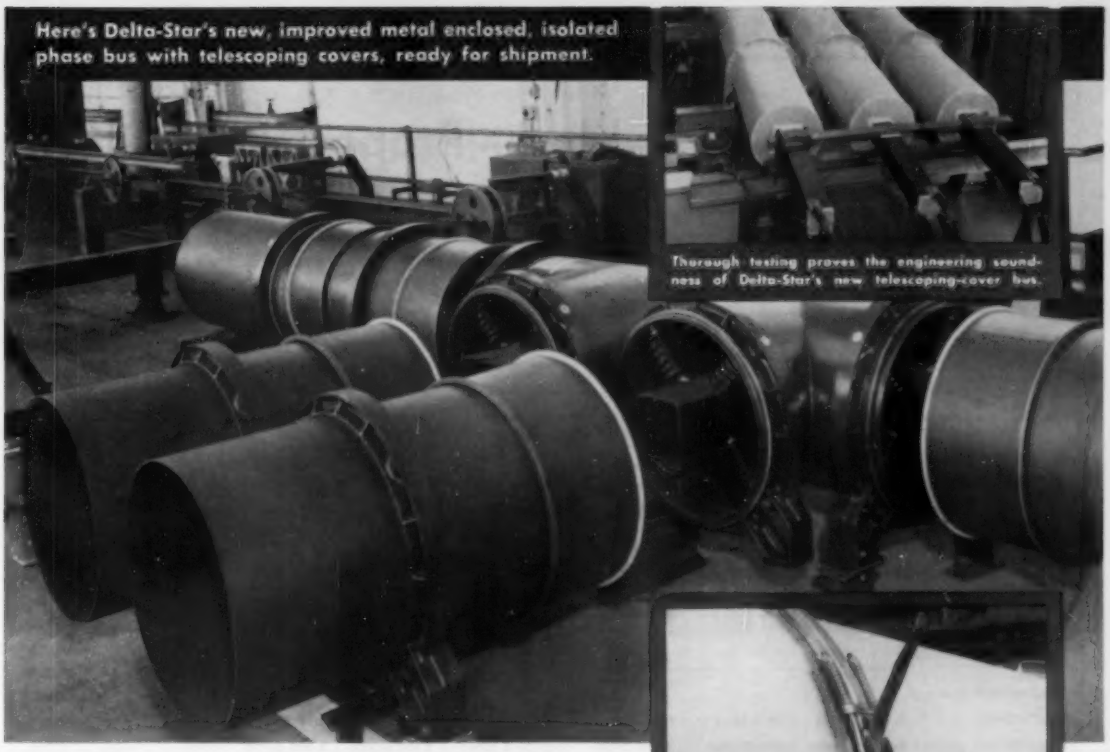
Data sheets for transformers and circuit breakers cover a 7-year period. Succeeding sheets will be placed over the old sheets until an insulation trend is established, and then old sheets will be filed.

Colored metal tabs are placed on the bottom of sheets to call attention to special conditions. A red tab indicates deteriorated insulation that requires close attention on the next test. And a black tab is used when other factors need attention.

Experience with the summary book during the first year has been very good. The company found that most of the data can be entered into the book in the field, immediately after making calculations. To facilitate recordings, a list of grading limits for each type of equipment will be inserted in the front of the insulation-test summary book.

(*More How To on page* 162)

Adapted from a paper presented at the 1955 Doble Client Conference.



Here's Delta-Star's new, improved metal enclosed, isolated phase bus with telescoping covers, ready for shipment.

Thorough testing proves the engineering soundness of Delta-Star's new telescoping-cover bus.

Lower costs—install new DELTA-STAR isolated phase bus with Telescoping Covers

Simplified installation and time and money-saving maintenance readily explain the popularity of Delta-Star's new metal enclosed, isolated phase bus.

Installation is simplified by eliminating bolted covers. Longitudinal sections 6 to 8 ft. long are pre-assembled and shipped in lengths as large as your facilities can handle. Telescoping covers are clamped into position and locked with two screws. There are no longitudinal gaskets to install.

Inspection and maintenance is quick and easy. Simply unlock the telescoping covers and slide them back. Spring loaded clamping assures air-tight seal against elements, moisture and dust.

There's no question about cutting installation and maintenance costs when you install the new Delta-Star telescoping-cover isolated phase bus. Investigate soon.

Closeup of telescoping-cover clamping ring with toggle opened. Cover slides back, exposing 2½ ft. bus area. Saves time and money on inspection and maintenance.

Clamping rings securely locked and bolted in position. Spring pressure and circular gaskets maintain tight seal. Use of circular gaskets reduces gasketing by 50%.

For the best in high voltage electrical equipment—specify DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

Table I – Properties of Plastic

Data Supplied by Manufacturers

Trade Name		LUMARITH			TENITE		GEON PLASTIC		
Type of plastic for classification		Cellulose Acetate			Cellulose Acetate	Cellulose Butyrate	Polyvinyl		
Filler (N) Not any		N	N	N	N	N	N	N	N
(E)xtruded, (C)ast, (F)ilm, (M)olded, (L)aminated		Solvent Cast	E	M	M & E	M & E	....	E	....
Manufacturer's Grade or Number		P903 Film	S-700	X Series	Tenite-I	Tenite-II	Rigid 9,750	8,800	2,042
Electrical Properties	ASTM Method								
Volume Resistivity, ohm-cm	D257	10^{13}	10^{13}	10^{9}-10^{14}	10^{15}-10^{17}	10^{15}-10^{17}	1.0×10^{13}	1.5×10^{13}	2.5×10^{13}
Dielectric Strength, vpm, 1/8 in. thickness, short time test	D149	2,300-3,000	1,100	250-365	290-600	250-400	1,400	800	700
Dielectric Constant, 60 cps	D150	....	....	....	3.5-7.5	3.5-6.4	3.70	....	6.12
10^3 cps	D150	4.4-4.8	5.1	3.5-7.0	....	....	3.62	....	6.12
10^6 cps	D150	3.7-4.4	4.4	3.2-7.0	3.2-7.0	3.2-6.2	....	....	....
Power Factor, 60 cps	D150	....	....	....	0.01-0.06	0.01-0.04	1.25	....	11.2
10^3 cps	D150	0.016-0.03	0.018	0.01-0.06	....	....	2.82	....	11.2
10^6 cps	D150	0.031-0.043	0.030	0.01-0.10	0.01-0.06	0.01-0.04	....	....	....
Arc Resistance, sec	D495	....	....	50-310	....	....	....	....	....
Mechanical Properties									
Specific Gravity	D792	1.26-1.31	1.29	1.37-1.34	1.24-1.31	1.15-1.22	1.38	1.38	1.34
Tensile Strength, psi: (s)tandard or (d)ry (approx 73F)	D638	7,000-12,000	5,500-7,000	1,900-8,500	2,250-8,100	2,600-6,900	6,400	3,500	2,300
Compressive Strength, psi	D695	....	....	13,000-36,000	2,200-10,900	2,100-9,400	9,600	....	....
Impact Strength, ft-lb/in., 1/2 x 1/2-in. notched bar, Izod test	D256	....	2.9	0.4-5.7	0.5-4.8	0.8-6.3	0.88	....	....
Hardness, Rockwell	D785	....	....	R40-125	R35-118	R31-116	....	....	....
Shore	D676	....	....	....	....	....	80D	79C	86A
Machining Qualities	....	Good	Good	Good	Good	Excellent	....	....	....
Thermal Properties									
Safe Operating Temperature, F	....	....	....	....	160	160	160	221	140
Flammability: (N)onflammable	D635	Slow burning	Slow burning to S	Slow burning to S	....	....	S	S	S
(S)elf-extinguishing, or burning rate	D757	....	....	....	....	....	....	....	....
Heat Distortion, 264 psi	D648	....	....	46-213	111-195	113-202	165	....	....
@ deg F. 66 psi	....	....	....	....	120-209	130-227	....	....	....
Brittle Temperature, F	D746	....	....	....	....	....	....	....	-5
Chemical Properties									
Water Absorption, 24 hr, %	D570	....	2-7	1.9-6.5	2.1-4.0	0.9-2.2	0.07	....	....
Resistance to Weathering	D795	Good	Good	Good	Poor	Good	Excellent	Excellent	Excellent
Basic Color	....	Clear	Unlimited	Unlimited	Colorless	Colorless	Ivory	Ivory	Ivory
Light Transmission	....	....	82-93	75-95	....	....	Opaque	Opaque	Opaque
Resistant to: (w)ater, (a)cids, al(k)alies, (s)alts, organic sol(v)ents, o(x)idizing compounds, (d)ilute acids, (h)ydrocarbons	....	W, weak A, weak K, S, Toluol, Benzol, Carbon Tetrachloride, Butyl Acetate	W, weak A, weak K, S, Toluol, Benzol, Carbon Tetrachloride, Butyl Acetate	W, weak A, weak K, S, Toluol, Benzol, Carbon Tetrachloride, Butyl Acetate	W, S	W, S	W, A, K, S, X	W, A, K, S, X	W, A, K, S, X
Not Resistant to (list as above)	....	Acetone, Methyl Cellusolve, Strong A & S	Acetone, Methyl Cellusolve, Strong A & S	Acetone, Methyl Cellusolve, Strong A & S	A, K, V, X	A, K, V, X	V	V	V
Uses	....	Spool liners, Spacers, Coil cores, Busbar insulators, Tapes, Condensers, Slot & layer insulation	Fuse winders, Busbar insulators, Dial crystals, Lighting fixtures	Connector blocks, Toggle switches, Telephone bases, Lightning arresters	Molded parts	Conduit, Bushings, Fuse pullers, Line testers	Conduit, Insulators	Primary insulation	Primary insulation, Cable jackets
Manufacturer	....	Celanese Corp of America			Eastman Chemical Products, Inc		B. F. Goodrich Chemical Co		

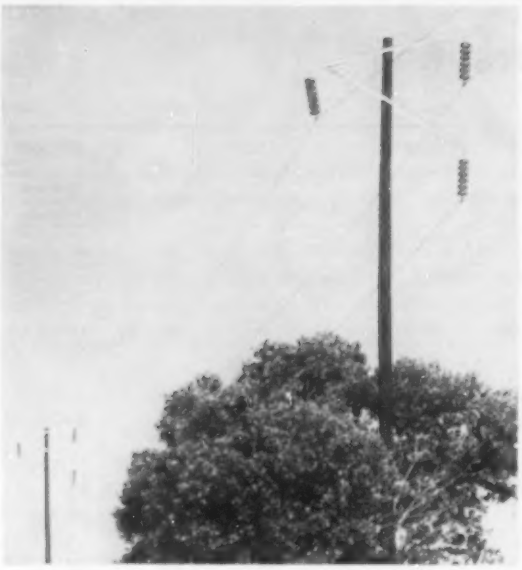
First in a series of four tables covering properties of typical plastics used primarily for electrical insulation.

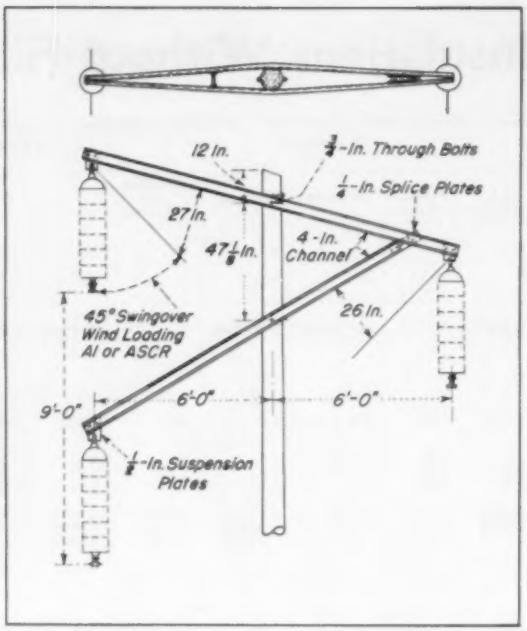
Other tables scheduled for forthcoming issues are: Molded Plastics with Fillers; ASTM-NEMA Grades of Laminated Thermosetting Sheets; and Laminated Sheet Insulation Not Covered by ASTM-NEMA Grades.

Insulations Without Fillers: Part 1*

BAKELITE					ALATHON		RULAN	ZYTEL			TEFLON
Polyethylene	Fluorothene	Phenolic	Styrene	Acrylonitrile Styrene	Polyethylene			Nylon (Polyamide)			Polytetrafluoroethylene
N	N	N	N	N	N	N	N	N	N	N	N
E	M & E	M	M	M	M & E	M & E	M & E	M & E	M & E	M & E	M & E
DFD2005	FYT5	BMG-5000	SMD-3500	C-11	PE2,142	4, BK90	1-NC10	101	21	63	Teflon 1 & 5
....	10^{15}	$3x10^{9}$	$>10^{15}$	$>10^{15}$	10^{17}	$6x10^{15}$	10^{14}	$4.5x10^{13}$	$4x10^{14}$	$3x10^{15}$	$>10^{18}$
1,050	408	350	630	418	1,100	2,600	940	385	470	420	500
2.3	2.68	5.9	2.5	2.8	2.27	2.60	2.7	4.1	4.6	10.7	2.0
2.3	2.55	5.4	2.5	2.79	2.27	2.60	2.7	4.0	4.5	8.9	2.0
2.3	2.34	4.7	2.5	2.74	2.27	2.60	2.7	3.4	3.5	4.5	2.0
0.0003	0.017	0.070	<0.0001	0.0066	0.0002	0.001	0.002	0.014	0.04	0.19	<0.0003
0.0003	0.026	0.046	<0.0001	0.0067	0.0002	0.001	0.002	0.02	0.04	0.18	<0.0003
....	0.008	0.035	<0.0001	0.0083	0.0002	0.001	0.002	0.04	0.03	0.14	<0.0003
....	....	....	....	....	30	30	....	185	155	126	600
0.92	2.14–2.15	1.37	1.05	1.075	0.92	0.93	1.29	1.14	1.09	1.13	2.1–2.2
1,600	5,800–6,800	9,000	7,200	11,700	2,000	2,300	1,500	10,500	7,000	7,400	2,500–3,000
4,000	....	36,000	....	....	....	....	....	4,900	3,000	800	....
....	....	0.89	0.37	0.40	No break	No break	....	1.0	1.0	16	3.0
....	111–115	....	68	82	....	....	....	R118	R111	R83	J-87–88
....	....	....	....	....	D48	D52	D55	....	....	....	D50–65
....	....	....	....	....	Good	Good	Good	Excellent	Excellent	Good	Like soft brass
....	....	....	....	....	....	....	....	250–300	200–250	170–190	500
....	....	....	....	....	1 in./min	1 in./min	0 in.	....	....	....	N
S	N	N	S	S	....	....	S	S	S	S	....
....	410	340	183	200	....	....	....	150	135	....	144
....	....	340	....	....	121	121	....	360	300	....	250
−75	....	....	....	....	<−105	<−148	−60	....	....	....	<−170
....	....	....	>0.05	>0.5	0.01	0.03	0.02	1.5	0.4	2.0	0.00
....	....	....	....	....	Poor	Excellent	Fair	Fair to good	Fair	Fair	Excellent
....	Translucent	Black, Brown	Water white	Light amber	White	Black	White	Light cream	Light cream	Cream	White
....	....	....	....	....	Translucent	Opaque	Opaque	Translucent	In sections	Thin	Translucent to opaque
....	A, V, X	....	....	A, K, H	W, A, K, S, V, X	W, A, K, S, V, X	W, A, K, S, V, X	W, K, S, V, X, D, H	W, K, S, X, V, D, H	W, K, S, V, X, D, H	W, A, K, S, V, X
....	....	....	....	....	Aliphatic, Aromatic, Chlorinated hydrocarbons	Aliphatic, Aromatic, Chlorinated hydrocarbons	Aliphatic, Aromatic, Chlorinated hydrocarbons	Strong acids, Phenol formic acid	Strong acids, Phenol formic acid	Strong acids, Phenol formic acid, Alcohol	....
Coaxial cables, Low-loss insulation	Wire insulation, Molded parts	Molded wiring devices	Molded parts, wiring	Molded parts, Terminal blocks, Battery cells	Power and telephone cables, Appliance wire	Power and telephone cables, Service-drop wire	H-V Cable, Flame-retardant injection-molded parts	Wire jackets, mechanical molding	Wire jackets, special mechanical molding	Wire jackets, Seals, Gaskets, Sheeting	Motor & transformer insulation, wire insulation, bushings, capacitors
Bakelite Co, division of Union Carbide and Carbon Corp					E. I. duPont de Nemours & Co, Inc						

* Part 2 of Table 1 will be published in a subsequent issue.





STEEL WISHBONE DESIGN is for use in semi-arid areas. Steel arms provide bonding, added strength, and longer life

Steel Wishbone Arms Cut Upkeep, Last Longer

J. N. KEITH, JR, Design Engineer, California Electric Power Co, Riverside, Calif.

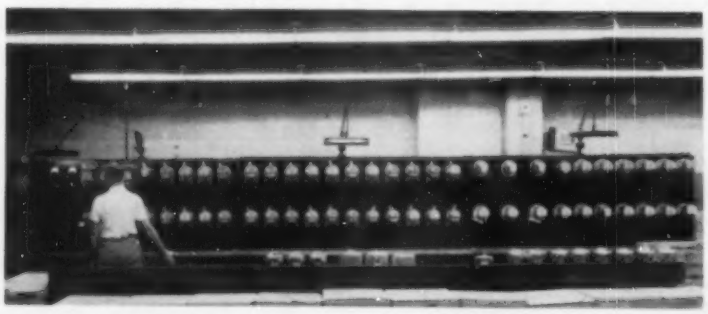
Less maintenance and longer life are expected of a new design of steel wishbone crossarms for single-pole 115-kv lines. Despite higher material prices, California Electric Power Co has found the installed cost of a pole framed with steel arms is only $5 greater.

In rebuilding a 90-kv line to 115 kv, Calectric returned to the use of steel arms to provide bonding and take advantage of steel's strength and long life in semi-arid service areas. Experience indicated the need for bonding for transmission and sub-transmission voltages.

The new wishbone design was developed to reduce installed costs. It utilizes straight 4-in. channel members bowed around the pole. Splice plates between the upper and lower arm members are ¼ in. Suspension plates at the arm ends are ½ in. The arm assembly is mounted to the pole with ¾-in. through-bolts without gaining.

Experience indicates that the unbalanced conductor loading inherent in the design does not cause undue pole distortion in class 2 cedar or douglas fir poles. This is particularly true if the two conductors are located on the up-wind side of the line.

METERING—Maintenance



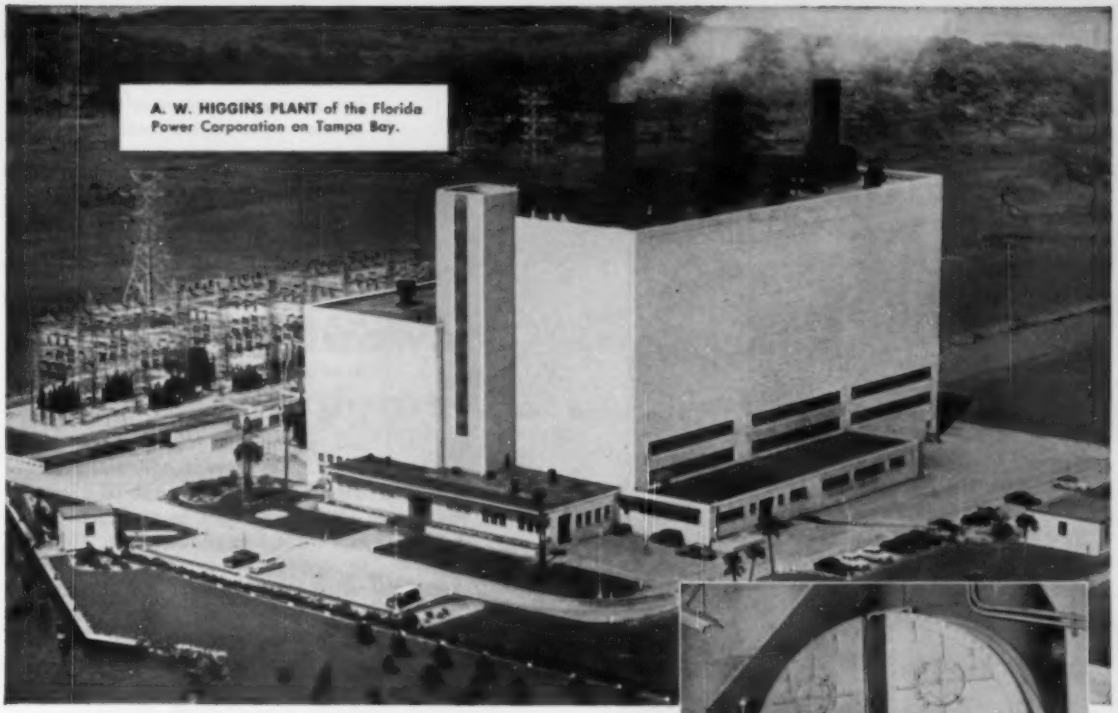
CAPACITANCE IS ADDED to raise voltage to desired level. Operator can add capacitance in five steps up to 77 mfd. Constant supply of 230 v is required

Capacitors Increase Number of Meters Tested

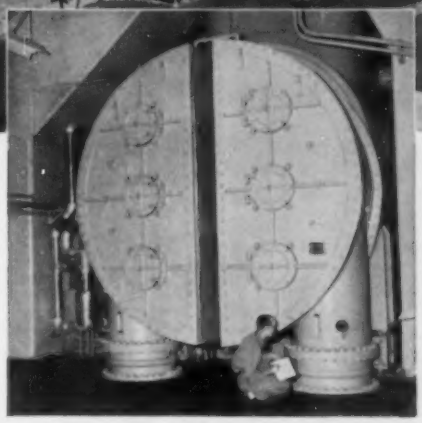
J. W. DYE, Superintendent, Meter & Test Section, Long Island Lighting Co, Hicksville, N. Y.

Capacitors located on a three-section meter test panel have enabled Long Island Lighting Co to increase its meter testing facilities. Adequate voltage obtained with the capacitors permits simultaneous testing of about 20 single-phase meters per section. Be-

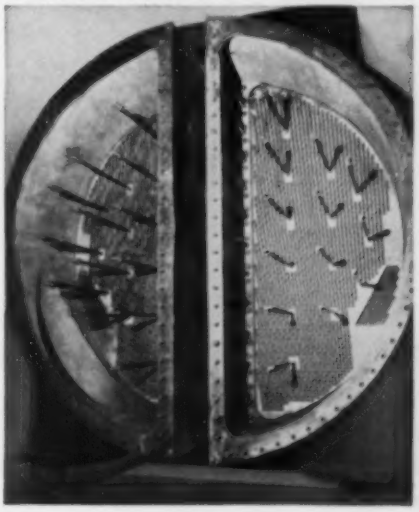
(*Continued on page* 164)



A. W. HIGGINS PLANT of the Florida Power Corporation on Tampa Bay.



Exterior view of one of the condensers in the Higgins plant, and below, one of the three condensers ready for tubing. Condensers made by C. H. Wheeler Mfg. Co., Philadelphia, Pa.



REVERE 10% CUPRO-NICKEL SOLVES CORROSION PROBLEM FOR FLORIDA POWER CORPORATION

About six years ago the Florida Power Corporation was experiencing condenser tube failure at its Bayboro plant in St. Petersburg. Revere's Technical Advisory Service was called in, and recommended replacing the failed tubes with 10% Cupro-Nickel, which has a marked resistance to corrosion from brackish water. This recommendation proved successful. As a result, when Florida Power planned to add a new 135,000 KW plant, named after A. W. Higgins, Revere 10% Cupro-Nickel tubes were specified. All three units in the new plant are thus tubed. The tubes are $\frac{7}{8}$" OD x 18 BWG, 24' 7" long. A few spares are kept on hand for possible replacement, but with regular cleaning to remove debris (small bits of shell, etc.), the tube life has been exceptional, thus adding to economy of operation and increased service to a fast-growing area. . . . If you have questions regarding condenser tube selection and service, get in touch with the nearest Revere Sales Office. Remember to specify Revere.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

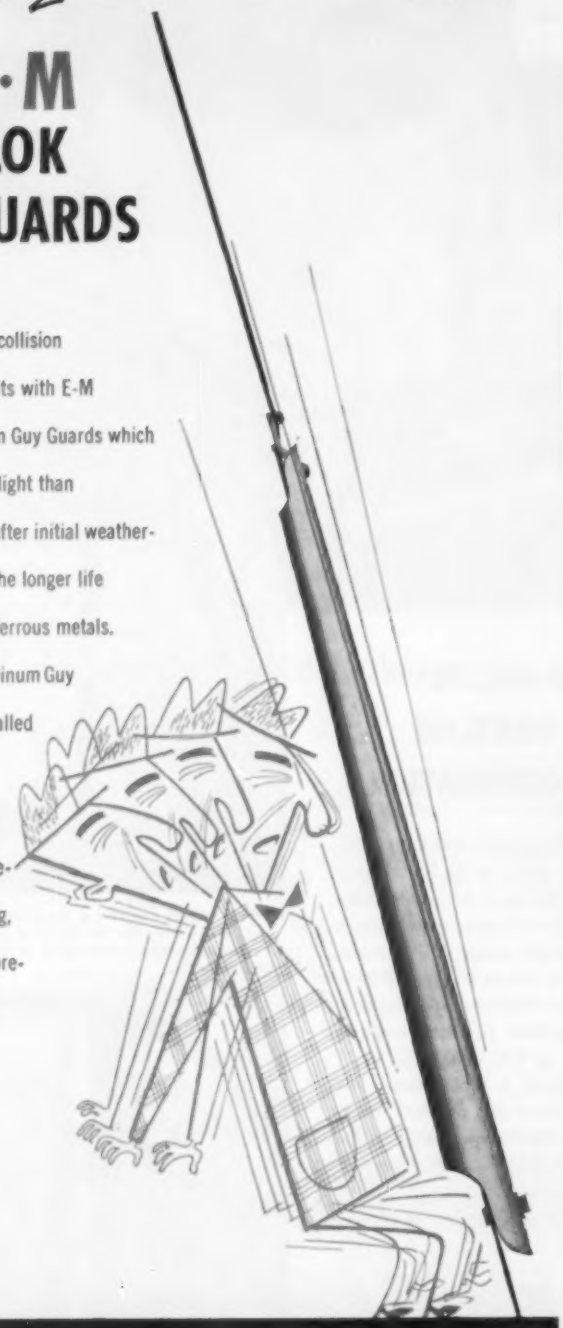
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.

Sales Offices in Principal Cities, Distributors Everywhere.

this is 1/2 as likely to happen with E·M QUIK-LOK GUY GUARDS

Prevent accidental collision and possible lawsuits with E-M Quik-Lok Aluminum Guy Guards which reflect much more light than galvanized guards after initial weathering. Save, too, on the longer life of aluminum over ferrous metals. E-M Quik-Lok Aluminum Guy Guards can be installed in 60 seconds or less by one man. A sample, our comprehensive new catalog, or a call by our representative is yours for the asking.



Designers and manufacturers of pole-line hardware that saves you time, money and maintenance. Prompt action on special problems. 52

EM

ELECTRICAL MANUFACTURING CO.

BATTLE CREEK, MICHIGAN

Meter Testing

(*Continued from page* 162)

fore adding the capacitors only about 12 meters per section could be tested as the poor power factor of the meter potential coils affected operation of the constant voltage transformer.

Various methods of improving the voltage were investigated including replacement of the constant voltage transformer. Capacitors were found to be the best solution. They cost less than 40% of the original cost of the transformer.

Capacitors can be added in 5 steps up to 77 mfd to correct phase angle and permit full operation of the panel. Size of capacitors was determined by trial and error.

Panel was built in 3 sections for ease of handling and installing. Thirty-six polyphase or 58 single-phase meters can be tested at once. Registers on both new and old demand meters can also be checked.

DISTRIBUTION—Construction

Sherman Products, Inc, Photo

Specially Equipped Tractor Digs Holes, Sets Poles

A tractor equipped with a back-hoe type of digger and a front-end loader has saved Service Pipe Line Co, Tulsa, Okla., time and money for digging holes and setting power-line poles. It is used where terrain does not permit the use of trucks because of the prevalence of loose rock and sandstone in the area.

The back-hoe digs 5-ft deep holes at an average rate of 40 per day. Previously, only 3 holes per day could be dug by hand. Cost per hole is now about 88¢ compared with the former cost ranging up to $16 in loose rock.

The front-end loader on the tractor is used for moving and setting the

(*Continued on page* 169)

Gathering answers for tomorrows' problems

TO SERVE THE POWER UTILITY INDUSTRY, O-B RESEARCH DOES MORE THAN "KEEP ABREAST"

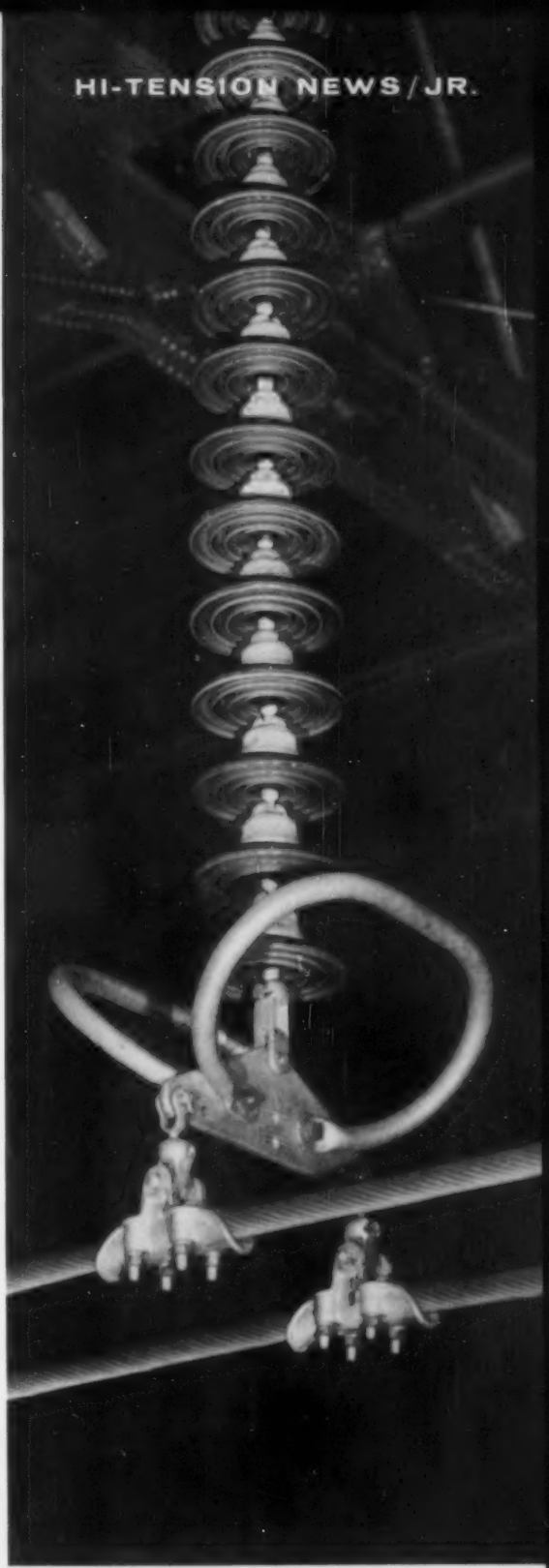
Researchers at the O-B High Voltage Laboratory seek now for the answers to tomorrows' transmission and distribution problems. Only by keeping a jump (sometimes two or three jumps!) ahead of current practice can we help in long-range development of new techniques. It's also the only way we can do a reliable job of assisting in the field problem that is bound to pop up "next week."

For instance, to your problem of insulator selection for extra-high voltage, add some unanswered questions about EHV hardware. In the Barberton High Voltage Laboratory, we've already used several years to investigate EHV insulator-hardware combinations. We still are at it. The result? We know some things that will work well. Equally important, we know some that won't! Ohio Brass Company is already rich in knowledge of techniques that may be as much as decades away for wide-spread commercial EHV transmission.

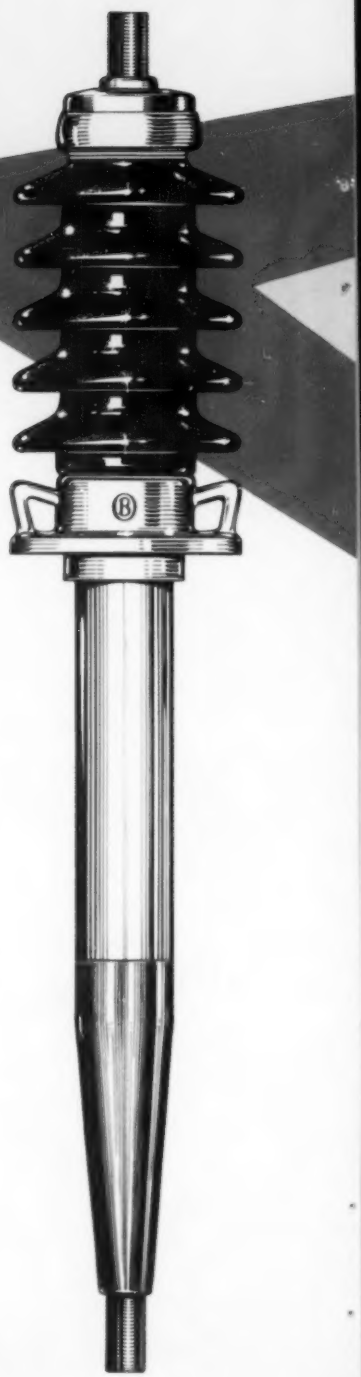
Constant research is a portion of the technical competence that keeps Ohio Brass ready to cope with every new industry problem. This competence can be helpful to companies now studying EHV possibilities. Call on us for an assist!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Ohio Brass



FULL CONDENSER CONSTRUCTION OF NEW O-B BUSHINGS EXPLOITS FINE QUALITIES OF PAPER DIELECTRIC



. . . Another Extra, Beyond ASA Standards, that accounts for high reliability and high value . . .

In addition to fully meeting the pencil-slim ASA Standard, it has been possible to work the paper insulation in new O-B bushings at a considerably lower unit stress than that encountered in many customary paper-dielectric applications. This provides a generous safety factor in a piece of equipment where extra reliability is a prime advantage.

Full condenser construction of the O-B core accounts for this desirable result. As is commonly understood, a condenser consisting of plates having equal area, and separated by an equal amount of paper dielectric, will effect a uniform division of voltage. Foil layers, whose length decreases with increased diameter, constitute such a set of plates. Precise separation is merely a matter of inserting these foils a certain number of turns apart during the winding operation. In this way, the inherent voltage-dividing property of a condenser is exploited in the new O-B design.

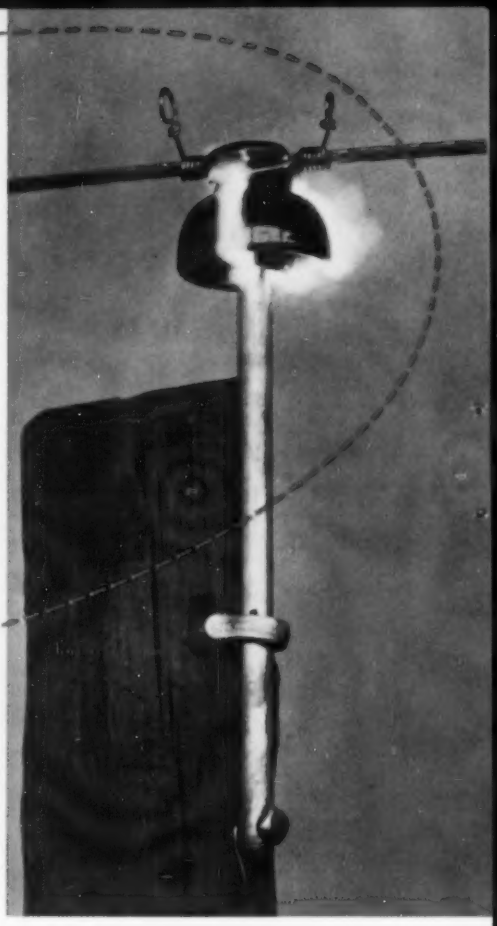
Throughout the total insulating core, each dielectric zone does the same amount of electrical duty. Within practical limits, grading of the entire core is uniform. Each dielectric zone is stressed far below the full insulating capabilities of the paper. Therefore, *all* the insulation works, and *none* of it is overworked. Such efficient use of the excellent dielectric qualities of paper permits adequate insulation within the small diameter restrictions of the ASA Standard.

How a bushing is built is, in no way, covered by national standards. Condenser construction is just one of many extra touches of quality, and one of many extra reasons for performance, you will find in O-B bushings. Specify O-B on your station equipment and put all these extras to work for you.

TECHNICAL COMPETENCE

the heart of every *Ohio Brass* bushing

the way we test pintypes shouldn't happen to a pintype!



To make sure O-B Pintypes stand up in low-voltage distribution systems, we tested some with *triple* the attack they'd be likely to meet in lightning exposure. Rate-of-voltage-rise is the characteristic of lightning that causes insulator damage. Natural lightning rate-of-rise normally falls in the range between 2000 and 5000 kv per microsecond. At the O-B High Voltage Laboratory we've smacked pintype production samples with steep-wave impulses *three times more steep!* And, as wave front rate-of-rise increases, its destructiveness is magnified at a vastly greater rate. The O-B Pintype shown here has sustained 14 shots of a wave front exceeding 14000 kv per microsecond! Its glaze is a bit scuffed up, but the unit is perfectly sound.

Statistically, lightning strikes a line once per mile per year in ordinary sections of the United States. You can figure on getting hit -- hard -- but you can also figure on sustaining the hits year after year if you insulate with O-B Pintypes!

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

*GraybaR QUALITY SINCE 1869 REG. U.S. PAT. OFF. Distributed by *GraybaR ELECTRIC COMPANY

4538-H

Special Tractor

(*Continued from page* 164)

poles and then for back-filling and tamping. In addition to the pole-line projects, the specially equipped tractor has also proved useful for digging trenches for crude lines and foundations.

TRANSMISSION and DISTRIBUTION
Maintenance

DOWNWARD STROKE strips off shell rot with a minimum amount of effort

Special Tool Shaves Standing Poles Safely

JOHN THOMAS, Stores Department, Salvage Division, Detroit Edison Co, Detroit, Mich.

Safer, easier, faster inspection and shaving of standing poles has been made possible by use of a special tool having a reversible blade for cutting in either direction. The blade is reversed by removing two nuts, which requires only a minute. This reversi-

UPWARD STROKE is possible by reversing blade attached with two nuts

If you want to know why fine FANNER ARMOR RODS are "superformed", look closely at the details of construction . . . because it is the details which make a difference to the line and the lineman . . . it is the details which denote a quality product.

For example, look at the clean, smooth rounded ends that eliminate the danger of nicking conductors or scratching linemen's hands . . . that minimize corona . . . and result in tight, tailored, form-fitting line reinforcements. Notice how every rod is exactly like every other rod of the same size regardless of the "lot", so that all can be matched in perfect sets. Fanner's manufacturing methods provide unvarying consistency of product dimensions to insure that all lots are identical and uniform.

For armor rods that always start right and end well — use FANNER Superformed ARMOR RODS — they cost you no more than other types! Write today for descriptive literature.

PACKAGED for PERFECTION, too!

FANNER Superformed Armor Rods are protected from end to end in sturdy full length cartons with contents fully identified. Rods stay clean, new and undistorted — *right up to the very minute they are used!* At slight extra cost they are also banded in sets of the proper number with extra-strength identifying tape that prevents breakage in shipping or handling — another feature that saves time, money and eliminates waste. It pays to use "FANNER"!

Licensed for use under Patent No. 2,275,019

THE FANNER MANUFACTURING CO.
Brookside Park • Established 1894 • Cleveland 9, Ohio

AGENTS IN PRINCIPAL CITIES

ARMOR RODS • TAP ARMOR • LINEGUARDS • PATCH RODS

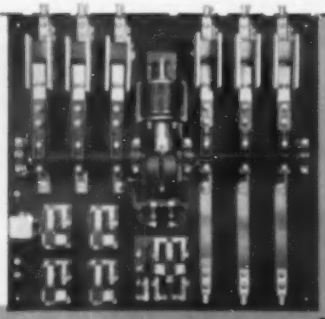
NO. 9 IN A SERIES ON ASSURED POWER CONTINUITY

...Why you should insist on built-in time delay when specifying an automatic transfer switch

Utility company experience tells us that normal power source distribution feeders are subject to occasional harmless momentary dips and outages, caused mostly by faulty loads, accidental grounds and electrical storms. When these last less than one second, they can be ignored. Yet, any one of these fluctuations can activate a transfer switch, causing false starts by the emergency power plant — *unless there is a built-in time delay.*

ASCO *Transfer Switches may be provided with built-in time delays, factory set for tripping at any point between 1 and 3 seconds. This delay permits the transfer switch to ignore momentary outages caused by transient conditions, resulting in smooth handling of the connected load, and reduced wear and tear on starting mechanisms. ASCO pioneered and still effectively employs this built-in protective feature on Automatic Transfer Switches.*

ASCO *Switches are specified by many well-known consulting engineers, utility companies, and municipal, state and federal agencies based on many years of proven field experience. ASCO Transfer Switches with built-in time delay are now demanded for more and more installations serving indispensable loads.*



COMPARE—
then insist on an ASCO
Automatic Transfer Switch.

ASCO Automatic Transfer Switches incorporate this built-in time delay (requiring no extra relays or additional moving parts) to protect generating equipment from false starts during momentary, harmless outages.

THIS INFORMATION SHOULD BE IN YOUR FILES—

Write for other advertisements in this series and for Publication 502 which gives many other reasons why you should always specify ASCO Automatic Transfer Switches.

ASCO®
Automatic Transfer Switches
Electromagnetic Controls
Solenoid Valves
Automatic Switch Co.
[illegible] Lakeside Avenue • Orange, New Jersey

ble feature allows a clean up job that was inpossible without it.

The new tool was developed at the request of overhead lines crews to eliminates the hazards of cutting men, safety ropes, or safety belts. The new tool was developed, tested in the field, improved, and tested again and again until the final product met with enthusiasm from the men using it.

It has an inherent balance which contributes to efficient, convenient operation. The men feel that the ideal blade and handle lengths have been attained. A removable guard covers the blade when it is not in use.

Shell rot strips off with minimum effort, and dressing of heavily spurred and knotty spots is easily accomplished.

Detroit Edison Co has arranged with a manufacturer to supply these tools.

SUBSTATION—Operation

Felt-Lined Trough Prevents Torn Charts

WILLARD HECHT, Substation Dept, Indiana & Michigan Electric Co, Fort Wayne, Ind.

A felt-lined chart trough has been built by the Fort Wayne Division of Indiana & Michigan Electric Co to aid winding OCB analyzer charts tightly around the drum. This prevents the chart from being torn by the recording pencil.

The chart trough consists of a 3-ft length of 6-in. eaves trough lined with ½-in. thick felt and mounted on wooden legs. It was made for approximately $5, including material and labor.

In use, the new chart roll is laid in the trough and attached to the drum. A slight pressure between the felt and the chart roll while turning the drum will wrap the chart tightly. The rolled edge of the trough makes an ideal back-up while wetting the gummed edge of the chart.

For Your METERING REQUIREMENTS

HD DEVICES

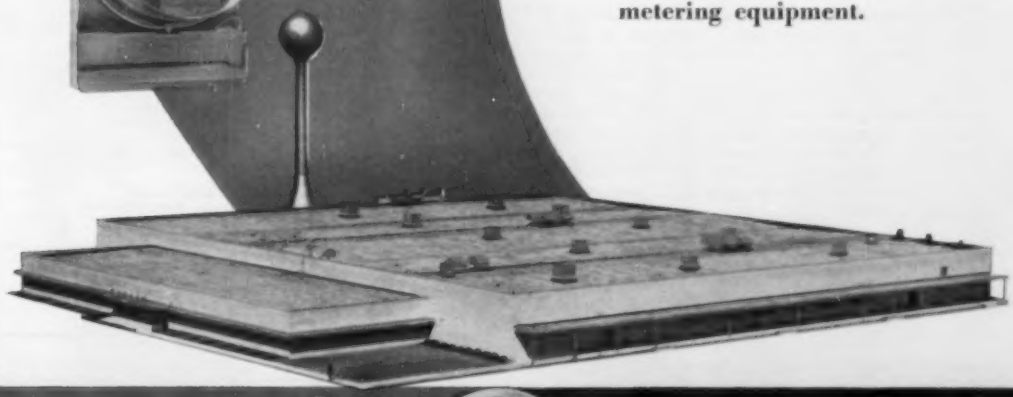
SOCKETS

MOUNTING DEVICES

SINGLEPHASE WATTHOUR METERS

DEMAND METERS

POLYPHASE WATTHOUR METERS



DUNCAN'S more than half-century of engineering and production *know how*—operating in modern plant facilities—is your guarantee of sound watthour meters and metering equipment.

DUNCAN

WATTHOUR METERS

Aerial view of new Duncan Plant. Completely air conditioned—modern in every respect.

DUNCAN ELECTRIC MFG. CO.

LAFAYETTE, INDIANA

ELECTRIC POWER

DELCO-REMY A.C. GENERATORS FOR EXTRA-HEAVY ELECTRICAL LOADS

Delco-Remy's new 6- and 12-volt A.C.-D.C. charging systems are the answer to the *extra-heavy* electrical demands of late-model municipal or public utility trucks, cars, and other vehicles equipped with two-way radio, floodlights, or other special electrical units. High wattage output is ample for heaviest electrical loads . . . generators pick up discharged batteries quickly in emergencies. Delco-Remy A.C.-D.C. charging systems are unexcelled at curb-idle . . . furnish up to 180 amperes at higher engine speeds . . . are dependable under the most rugged operating conditions at all engine speeds.

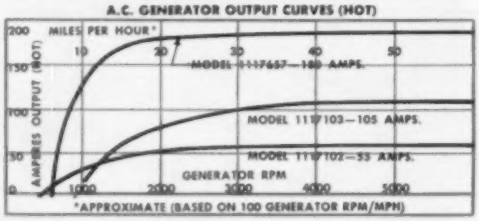
Application packages for both 6- and 12-volt generators, complete with installation instruction sheets for popular makes of cars and trucks, are available. Conversion is simple. See your nearest United Motors distributor for additional data.

A.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes*	Maximum Amperes	Power Watts SAE	Recommended For
1117102	12	525	39	55	825	All speeds.
1117103	12	960	5	105	1575	All speeds.
1117657	12	550	130	180	2700	All speeds.
1117062-3-4	6	750	38	90	720	All speeds.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

A.C. GENERATOR OUTPUT CURVES (HOT)



*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

DELCO-REMY D.C. GENERATORS FOR MEDIUM-TO-HEAVY ELECTRICAL LOADS

Delco-Remy's 6- and 12-volt extra-output D.C. generators are an economical answer to the electrical needs of late-model municipal or public utility trucks, cars . . . other vehicles with additional lights, two-way radios, or other special electrical equipment in medium- to heavy-duty service in suburban areas. Delco-Remy extra-output D.C. generators are low in cost, simple to install, economical to maintain. Performance data on Delco-Remy extra-output D.C. generators are shown at the right.

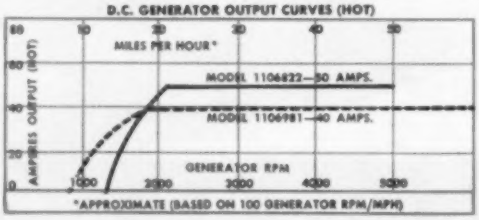
For further details and application data, see your nearest United Motors distributor.

D.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes*	Maximum Amperes	Power Watts SAE	Recommended For
1106822	12	1300	0	50	750	Low to Medium Speeds
1106981	12	825	14	40	600	Low speeds & idling.
1106757	6	820	†	55	440	Medium to high speeds.
1106758	6	560	26	45	360	Medium Speeds and Idling
1106977	6	610	38	55	440	Low speeds & idling.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

D.C. GENERATOR OUTPUT CURVES (HOT)

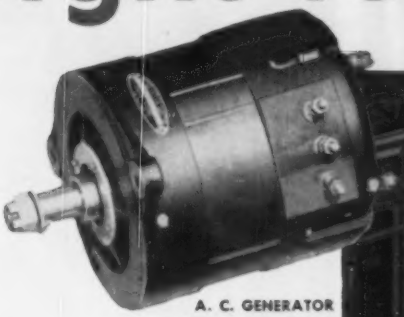


*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

Delco-Remy
ELECTRICAL SYSTEMS

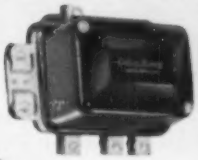
DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

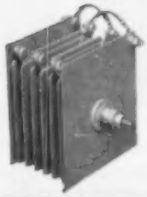
right for the job



A. C. GENERATOR

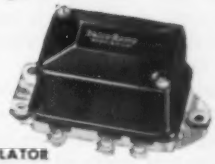
REGULATOR





RECTIFIER

D. C. GENERATOR



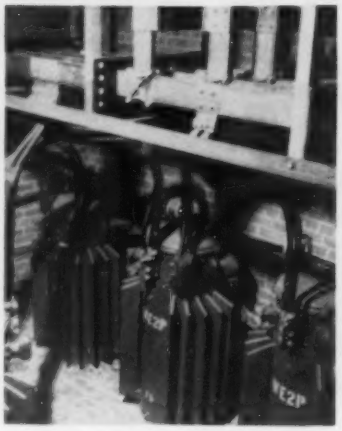
REGULATOR

A GENERAL MOTORS PRODUCT GM UNITED SERVICE MOTORS A UNITED MOTORS LINE

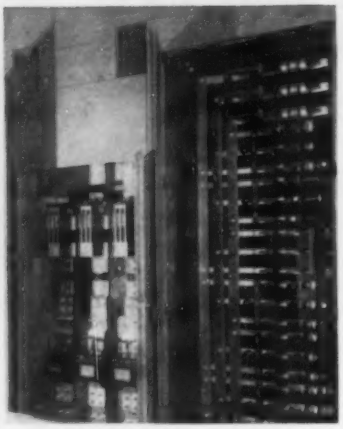
DISTRIBUTED BY WHOLESALERS EVERYWHERE

Wiring Overhauled for Load Growth

A. L. CARROLL, Manager, Technical Services, Con Edison, Mt. Vernon, N. Y.



TRANSFORMER VAULT is directly behind the main distribution panel . . .



. . . WHICH ROUTES POWER to subdistribution panels situated in plant

The transformer vault and plant power distribution system at University Loudspeakers, Inc., White Plains, N. Y., has been revamped to accommodate fast-growing load in this expanding plant.

Originally a 1,200-amp service fed the plant. Incoming power was transformed to 208-v, 3-phase, 4-wire for distribution. Eight 100-amp and two 200-amp switches were used on the old distribution panel.

The original 1,200-amp service was replaced by a 3,000-amp service. The present distribution system consists of three units:

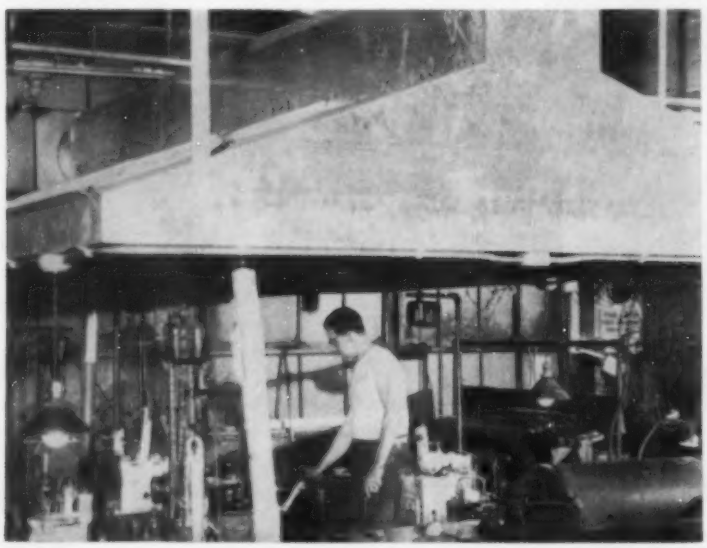
- One unit of 1,600-amp capacity, consisting of one 400-amp switch and six 200-amp switches.
- One unit of 2,000-amp capacity, consisting of five 400-amp switches.
- One unit of 2,400-amp capacity, consisting of one 400-amp switch and ten 200-amp switches.

These distribution switches feed branch distribution panels located at various points throughout the plant for production convenience.

A total of 6,000 amps of distribution capacity has been provided, with provision left for installation of a future 1,500-amp board if required, making a total ultimate capacity of 7,500 amp.

Fuse-clip clamps on all main distribution switches minimize heat at the clip connections. Otherwise this heat tends to become excessive. This kills the temper of the copper switchblades and their contacts and breaks down and destroys the fuse.

In planning the new distribution layout, Harry Weissman, plant engineer for University Loudspeakers, and the A.A. Switchboard Co, Inc, of New York City, who fabricated the equipment, sold management on providing surplus capacity for future electrical growth. More-than-adequate wiring was put in, and this plan of attack began paying off only three months later when management bought a three-phase 100-kva welding machine which had not been anticipated. The welder was added without worry, and without pushing the distribution system close to its limit.



Fan Exhausts Fumes Through Big Hood

J. M. JENNINGS, JR., Industrial Representative, New Orleans Public Service, Inc, New Orleans, La.

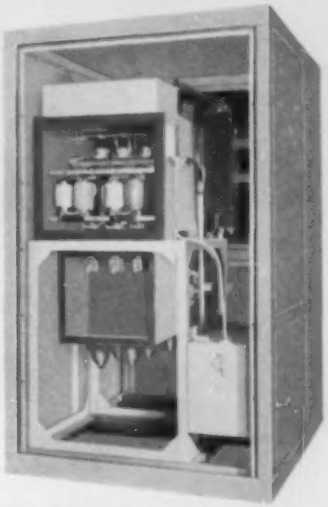
A high-speed, ⅛-hp fan now exhausts heat and fumes rising from type metal machines to a large metal hood in the composing room of the New Orleans *Item*.

This installation was made to solve a problem posed by a new air conditioning system in the room. Previously window fans ventilated the room satisfactorily. But the air conditioning system was not designed to accommodate the quantity of fresh air makeup that would have been required to continue this practice.

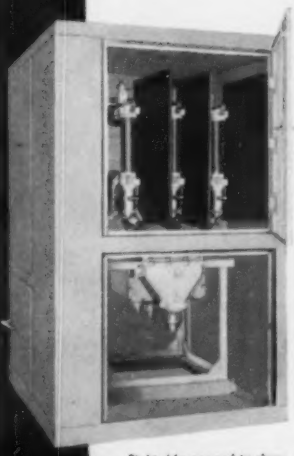
(*More Industrials on page* 178)

G&W "UNICLAD" Primary Service Switch-Fuse Units

enclosed in metal cabinets for safety and appearance.

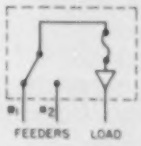


Left side panel and cover plates removed to show details of oil switch (with control transformers) and of cable terminating compartment. Also note Model "F" automatic operating mechanism. Oil switches can be furnished for full load break manual operation instead of automatic.



Right side opened to show disconnecting type power fuses and load cable pothead. The pothead can be 3 conductor as shown or 3 single conductor—or less potheads for rubber insulated cables in dry locations.

TYPE "U-SC-RAD-F" UNIT including: Feeder selector oil switch, 3 pole, 15 Kv., 400 amp. full load break; with Model "F" automatic transfer mechanism. "SC" power fuses and pothead for load connection.



G & W combination load break oil switch-fuse primary service units—in economical functional designs have been furnished for many years. They help maintain service continuity and provide load circuit protection. They have a remarkable record of trouble-free operation—with a minimum of maintenance.

The oil switches, fuses and other component parts are now factory assembled as UNICLAD metal enclosed units—which present a neat and harmonious appearance in indoor or outdoor locations. The enclosure of porcelain bushings, live lugs and connections promotes safety.

The arrangement of equipment within the UNICLAD enclosure is such that ready access is provided for termination of feeder and load cables, for maintenance of oil switches and mechanism and for replacement of fuses.

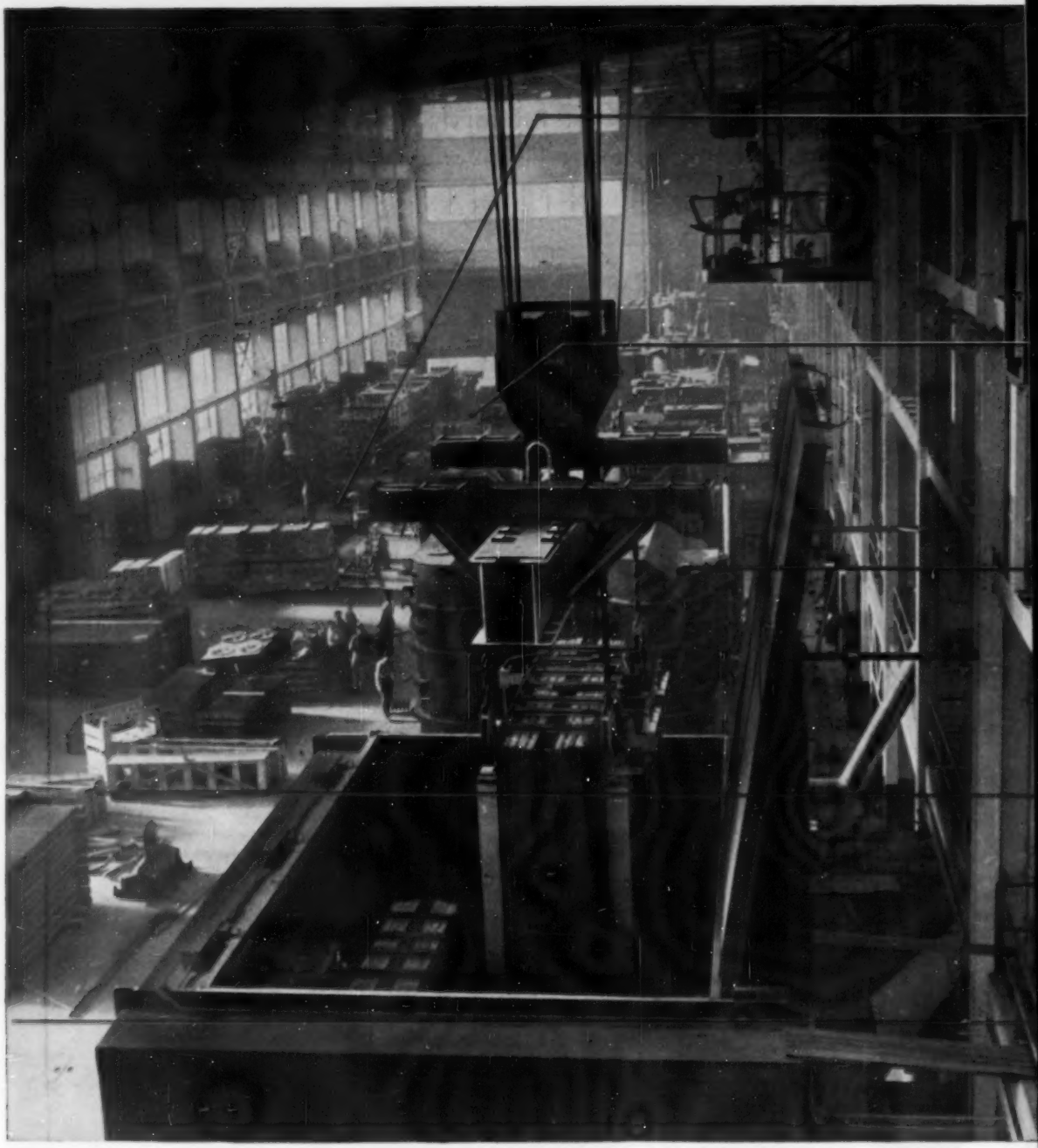
UNICLAD switch-fuse units are custom designed for practically any primary service center requirements.

Get in touch with us or our representatives for further data and prices on "Uniclad" Switch-Fuse units to meet your requirements.

G & W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois, U.S.A.

Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

D557

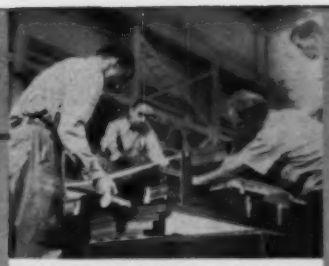


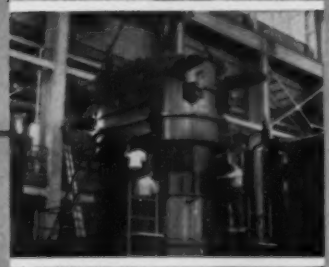
M O L O N E Y E L E C

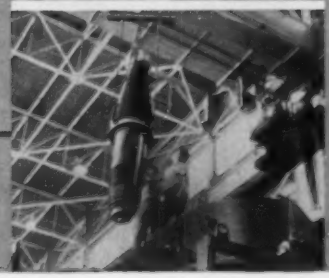
Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating

Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT







SPEAKING OF HIGH Kva . . .

Within Moloney's large power transformer bay, men and machines are building dependable power transformers in higher Kva and voltage ratings. Moloney can supply transformers for your utility system requirements . . . regardless of size and voltage rating.

Specify Moloney . . .

Get Dependability at its Best

M639-44

T R I C C O M P A N Y

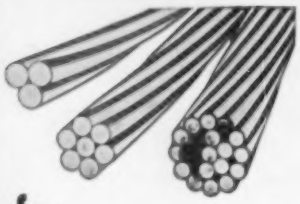
Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary
Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

MOLONEY ELECTRIC

ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

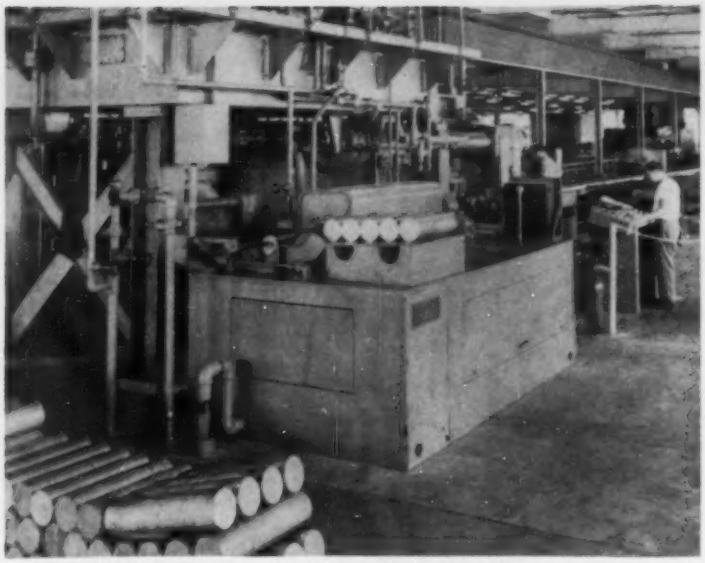
Write us at Monessen, Pa., for complete information

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value



INDUCTION BILLET HEATER, with 750-kva capacity at 85% pf, takes 6 to 8-in. aluminum bars and warms them to about 950F. This machine is 3-phase, 60-cycles

Induction Extruder Presses Aluminum

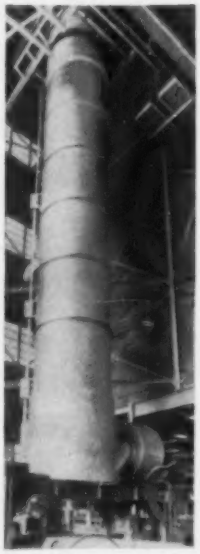
CHARLES T. HEATON, Industrial Sales Representative, Union Electric Co of Missouri, St. Louis

Induction heating is used in the extrusion of shapes for aluminum window frames by Cupples Products Co, in its St. Louis plant.

A 400-kw, 60-cps, 3-phase induction heating coil in the first extrusion press, bought in 1949, proved so successful that a second press with 750 kw of induction heating capacity was installed.

Alloy billets are fed automatically into the induction coil for heating, then pass through the extrusion dies and on out the far end to a conveyor table.

After straightening in a hydraulic stretch press, some of the lengths are heat treated in a 450-kw vertical oven which is about 70 ft high. A water quench tank 60 ft deep is immediately under the oven.



HEAT TREATING is done in 75-ft tower

AFTER STRETCH STRAIGHTENING in this 35-ton hydraulic device, driven by a 15-hp motor, aluminum extrusions get 925F heat treatment in 450-kw tower (above)

you get ALL-WEATHER INDICATION with this porcelain enclosed cutout

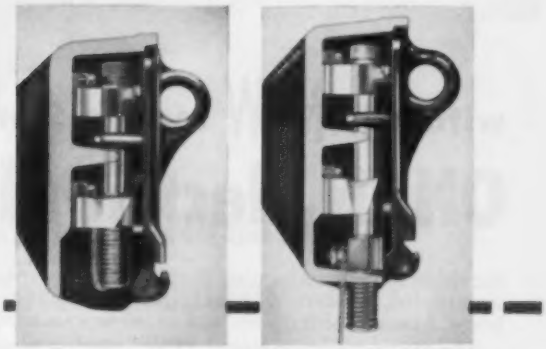
RATINGS
50 Amps
5 and 7.5 Kv
Interrupting Cap.
1200 Amps

No matter what the weather conditions—rain, snow, sleet or ice—the Matthews Dropdown Cutout operates unfailingly...always gives positive indication when the fuse link has blown.

Even though the door of the housing might be frozen shut, an outage is indicated.

When the fuse element melts, the compressed spring (see inset pictures below) is released. This action separates the contacts and forces the telescoping assembly down through an opening in the bottom of the cutout. Such easily visible projection tells the trouble-shooter that the cutout has operated.

Cutout door is held closed at all times by the upper contact clips to prevent rain, snow and ice from entering the housing. Using gloves or a disconnect stick, a lineman can safely remove the door for inspection or easy refusing.



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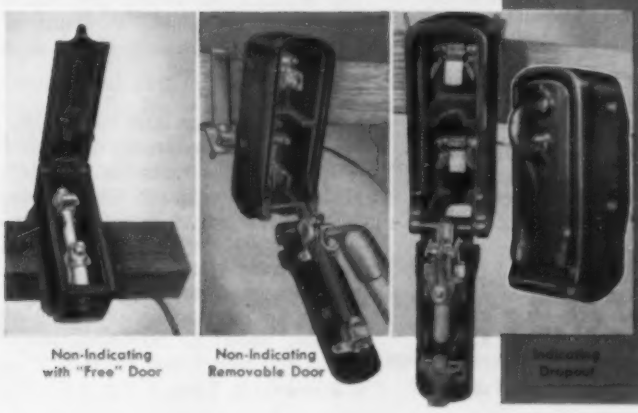


Non-Indicating with "Free" Door

Non-Indicating Removable Door

Indicating Dropout

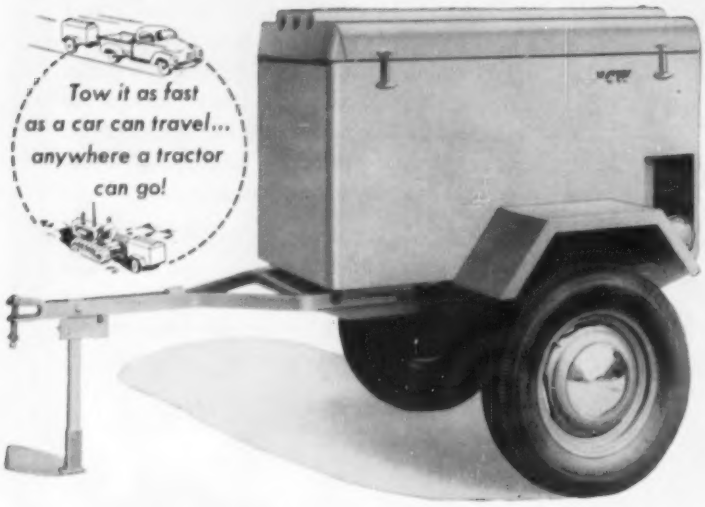
The exposed end of the fuseholder is dead when in an indicating position, as it is separated from the lower contact by a 1" air gap. If the lineman leaves as much as ⅛" of slack when re-fusing the link, the wedge and spring contacts automatically remove this slack when the door is closed.

A·B·CHANCE CO·

CENTRALIA, MISSOURI

San Francisco, California

Keep customers happy when power's off!



with this NEW mobile 5 or 10KW ONAN Electric Plant!

Servicing sometimes requires that highline power be temporarily interrupted. Or storms, floods or fires may cut power to a farm, home, business or industry and cause serious losses.

The Onan trailer-mounted "CW" electric plant is made to order for situations like these. It can be rushed to the spot, hooked up, and within a very short time your customer is operating normally.

Onan "CW" Electric Plants are unusually compact, quiet-running and economical to operate; weigh only half as much as water-cooled plants of the same capacity. Powered by Onan two-cylinder, suction-air-cooled gasoline engines built with massive, long-wearing parts for continuous, heavy-duty service. Fully protected by heavy-gauge steel housing; stays on the job in any weather.

Wide range of accessories make the "CW" more versatile

You can equip your "CW" Electric Plants for any type of portable service. Accessories include skid, battery rack, 9-gallon fuel tank, weather-proof housing, two-wheel trailer, or 4-wheel rubber-tired dolly. Keep one or more of these portable, high-capacity units on hand for emergency or auxiliary use!

Onan builds electric plants for every need—500 to 50,000 watts

Write for folder A-362

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

2947 University Ave. S. E. • Minneapolis 14, Minnesota

INDUSTRIAL BRIEFS

Converting a sheet-metal planer into a buffing machine is saving time and space for F. H. Lawson Co, Cincinnati, Ohio, and is yielding a higher quality buffed product. The machine works automatically, does the work of three hand-buffers, and reduces manhours per unit to one-third the former value. A high-reactance squirrel-cage induction motor drives the planer table. This reversible motor is rated 7½ hp, 240 v, 3 phase, 60 cycles. Two buffing wheels polish the sides of the sheet metal frame, and two other wheels buff the top. Each buffer is driven by a 5-hp induction motor mounted on pedestals which can be adjusted up and down, in and out, or canted. Limit switches reverse the table motion, and a motor brake prevents overtravel when power is turned off or interrupted. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

Making shell molds at Univertical Foundry & Machine Co Plant, Detroit, is done by blowing a mixture of sand and thermo-setting resin into electrically heated book-type molds which operate at 600F. Four cartridge-type resistance heaters are built into the molds. The shell molds that emerge are oval-shaped and have inside dimensions of 1½ in. by 3 in. They are 10 in. long and are formed with male and female ends to facilitate assembly. Used in casting either nickel or copper anodes, they enable any desired length of anode, up to 100 in. to be obtained. The proper number of shell molds are joined for this operation. The sections are produced at the rate of 120 an hour. Close temperature control is required and electric heat excels in this respect. M. W. Heidman, Power Sales Engineer, The Detroit Edison Co, Detroit.

Space heating with three 1-kw electric panel heaters has proved satisfactory in an 8 x 10 x 8 office of Leonard's Metal Forming Co, St. Charles, Mo. During the winter, outside temperatures dipped as low as 15F. The panel heat replaced an oil burner. Panels not only made the office cleaner and safer, but also increased available floor space. Robert E. Enkelmann, Industrial Engineer, Union Electric Co of Missouri, St. Louis.

G.E. selects Enjay Butyl for versatile indoor-outdoor transformer casing

The use of Enjay Butyl in General Electric's molded transformer housing solved *three* particular problems—*insulation, support, casing.* G.E.'s engineers found that Enjay Butyl has low moisture absorption, fine resistance to corona and sunlight, and excellent adhesion to copper. In addition, it has a low power factor and good resistance to impact damage.

In electrical manufacturing and design, Enjay Butyl offers three outstanding features: excellent electrical properties, low cost, and immediate availability.

Enjay Butyl may well cut costs and increase the performance of *your* product. Get the facts on this extremely versatile, low-cost rubber. Complete laboratory facilities and technical assistance are at your service. Contact the Enjay Company today.

ENJAY BUTYL

Enjay Butyl is the super durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture

ENJAY **ENJAY COMPANY, INC.,** 15 West 51st Street, New York 19, N. Y.
District Office: 11 South Portage Path, Akron 3, Ohio.

35 SUCCESSFUL YEARS OF LEADERSHIP IN SERVING INDUSTRY

Dealers stock up for Christmas drive as Penelec-Meco find . . .

Lamp Shows Are "Bright Idea"

Utilities gear up retailers with display of new wares and high-powered ad campaign; low-priced lamps to be featured

"Here's a Bright Idea."

With that as a catch line and full belief that they can make local lamp shows pay off for manufacturers as well as the store owner, Pennsylvania Electric Co and Metropolitan Edison Co are conducting a series of such events in seven Pennsylvania cities as prelude to a "gigantic" Christmas push on lamps.

When manufacturers at first showed only luke-warm interest in the project, the utilities hand-picked a group of leading manufacturers, bought an order of lamps from them and invited dealers to the shows. Lamp representatives who showed up at the first show in Reading last month were amazed at the amount of business that was written.

Entire Trade Invited

Other shows are being held in Easton, York, Johnstown, Altoona, Clearfield and Erie. Department and furniture store buyers, lamp shop proprietors and appliance dealers in each area received personal invitations to attend the shows with a promise that the local electric company will help them increase lamp sales this year. The shows give buyers and sales personnel unable to attend the annual New York show a chance to see what's new in lamps and give manufacturers an opportunity to pick up new accounts.

Give Ad Assistance

To help sell dealers the companies display colorful advertising material billed as "bright ideas to increase your lamp sales." These ideas include a series of advertisements, scheduled for 88 local newspapers, which point out that "a lamp makes a wonderful gift for mother, sister, dad, brother, aunts and uncles" and that "prices fit every pocketbook." The ads stress the prices of $4.95, $9.95 and $14.95 which a survey showed are the most popular lamp gift prices in the Meco-Penelec territories. Buyers attending the shows are urged to be ready for the promotional push by stocking up on lamps in this price range. Last year in a utility-sponsored "Buy a Lamp for Christmas" campaign stores in many local areas didn't have stocks to meet the demand.

Besides newspaper advertisements, the utilities are using these media:

- Three-color truck and car posters which will be placed on 700 company trucks and made available to dealers.
- Window and interior display pieces.
- Sales tags for use on dealers' merchandise.

The "Christmas Lamp Sale" tag bearing red and green holiday ornamentation is being carried as a trade mark of the promotion. The tags themselves are furnished to dealers for affixing to lamps on their display floors, and replicas appear in all advertisements and displays.

The two companies say that the idea of promoting lamps as ideal Christmas gifts is only a starter in a year-around promotion of lamps. They are getting special activities ready for Mother's Day, Father's Day, June brides and graduation.

Theory behind this lamp sales activity: The sale of lighting is important in itself and the big need is to stimulate customers to buy more lamps. One of the best ways to do this Meco and Penelec feel is sell the idea that lamps and lighting improve the appearance and value of a home.

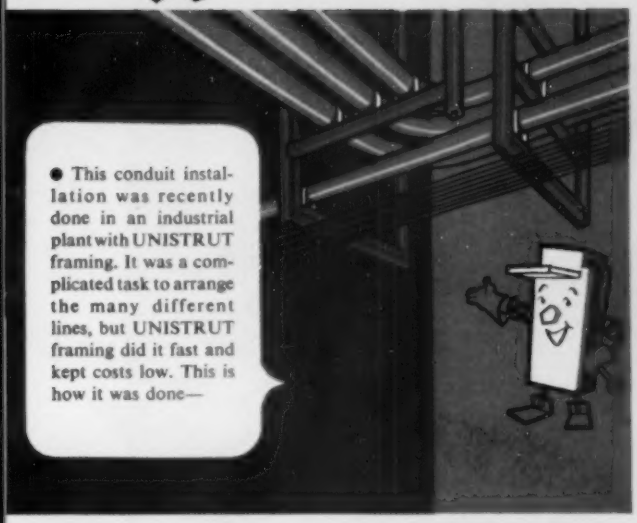
ADS PLUG $4.95 to $14.95 lamps after survey shows them to be most popular

(*More S & S on page* 184)

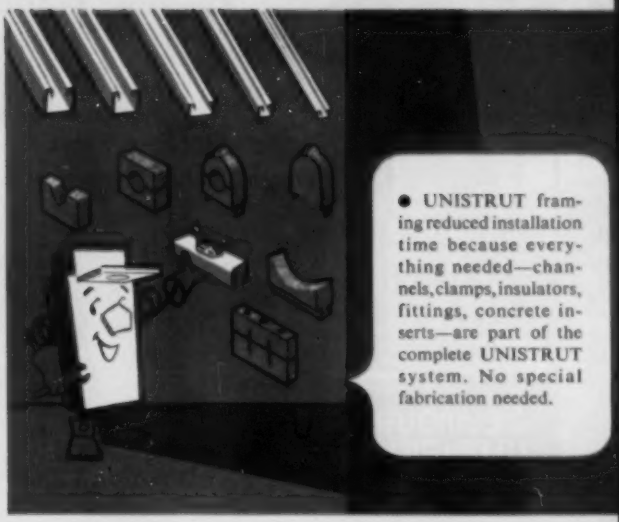
"The Sky's The Limit"

—when you build with UNISTRUT®

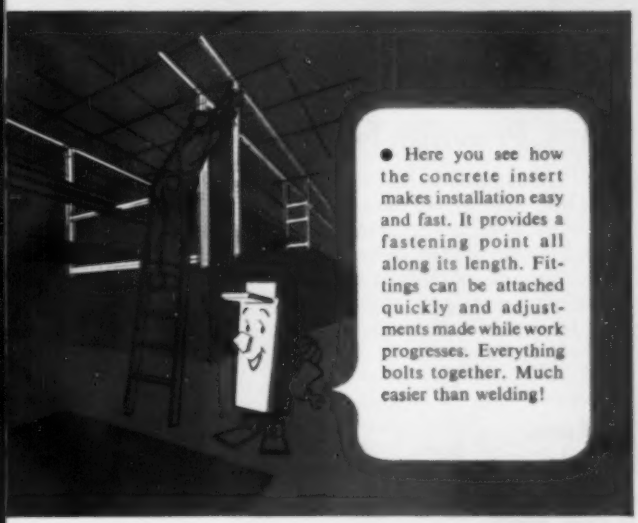
Mr. Strut shows way to save space, money on conduit racking with UNISTRUT® framing



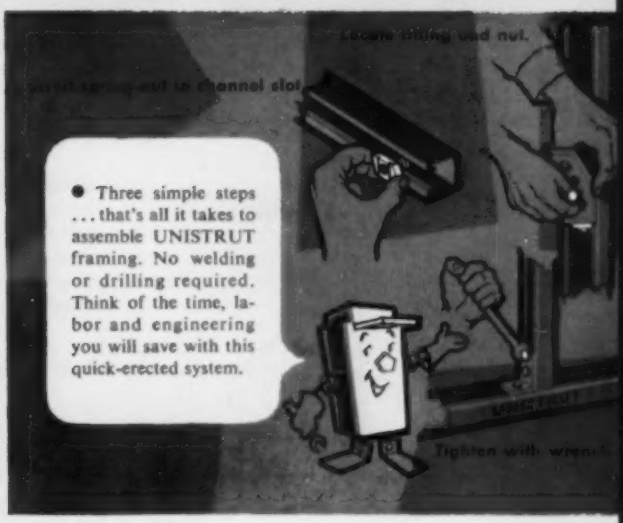
● This conduit installation was recently done in an industrial plant with UNISTRUT framing. It was a complicated task to arrange the many different lines, but UNISTRUT framing did it fast and kept costs low. This is how it was done—



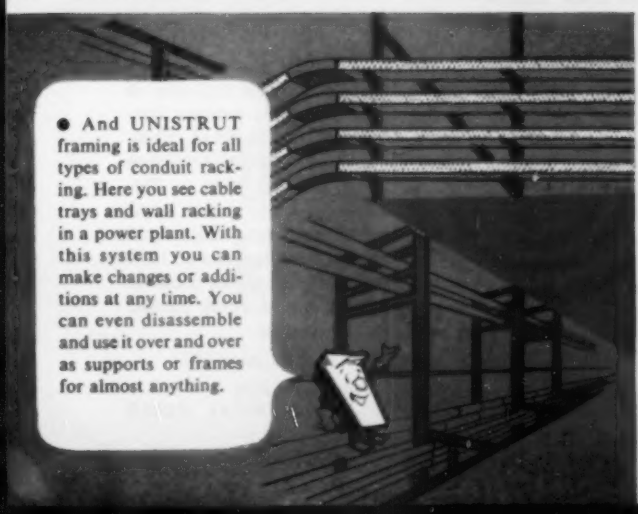
● UNISTRUT framing reduced installation time because everything needed—channels, clamps, insulators, fittings, concrete inserts—are part of the complete UNISTRUT system. No special fabrication needed.



● Here you see how the concrete insert makes installation easy and fast. It provides a fastening point all along its length. Fittings can be attached quickly and adjustments made while work progresses. Everything bolts together. Much easier than welding!

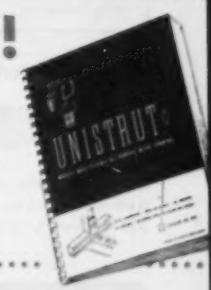


● Three simple steps . . . that's all it takes to assemble UNISTRUT framing. No welding or drilling required. Think of the time, labor and engineering you will save with this quick-erected system.



● And UNISTRUT framing is ideal for all types of conduit racking. Here you see cable trays and wall racking in a power plant. With this system you can make changes or additions at any time. You can even disassemble and use it over and over as supports or frames for almost anything.

Free Catalog!



Send today for your free copy of the 78 page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment..

2327587 2363382 2329815 2380379
2541908 2696139 2545650 2405631
Other patents pending

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Illinois

Please send without obligation items checked below: Dept. W-10

☐ Catalog No. 700 ☐ UNISTRUT sample

Name.....

Company.....

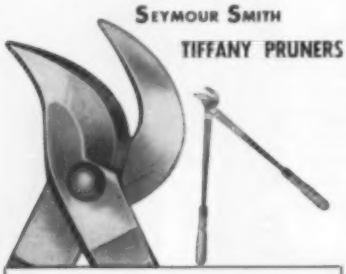
Address.....

City..... Zone..... State.....

Illustrated above is No. 11 Tree Pruner with center cut action by tempered steel blade that easily handles 1" branches. Head is reinforced malleable iron. Spruce poles with telescoping aluminum joints. For heavier work No. 12-18, capacity 1½". Also Pole Saws.

for clearing brush...

SEYMOUR SMITH
TIFFANY PRUNERS



Hand forged throughout. Fast and easy double cut action with thin blades shaped to "draw in." Improved bolt and nut joint, through handle and riveted grip fastening.

FAST-CUTTING SAWS

Blades of Swedish charcoal steel. Large, deep teeth with heavy set to prevent binding. Hand and Pole models for all work up to chain sawing.

Quality Tools
SEYMOUR SMITH
Since 1868

Send for FREE literature
Seymour Smith & Son, Inc.
2410 Main St.,
Oakville, Conn.

Electric Hotbeds Prevent Frost

Early spring plantings are not damaged by late frosts since O'Brien Greenhouses, Kent, Wash., wired their hotbeds with electric heating cable. Each of the ten 6x60-ft hotbeds is wired with plastic-covered, 2.57-kw, 240-v heating cable. Spaced 1½ in. apart on cleats, the cable circles the inside of each hotbed seven times. With the thermostatic control set at 35 F, plants in the heated beds were protected when outside temperature dropped to 13 F. Unprotected plants were severely damaged.—John Reynolds, Farm Electrification Representative, Puget Sound Power & Light Co, Kirkland, Wash.

Who Owns TV? Rural Families Lag Behind

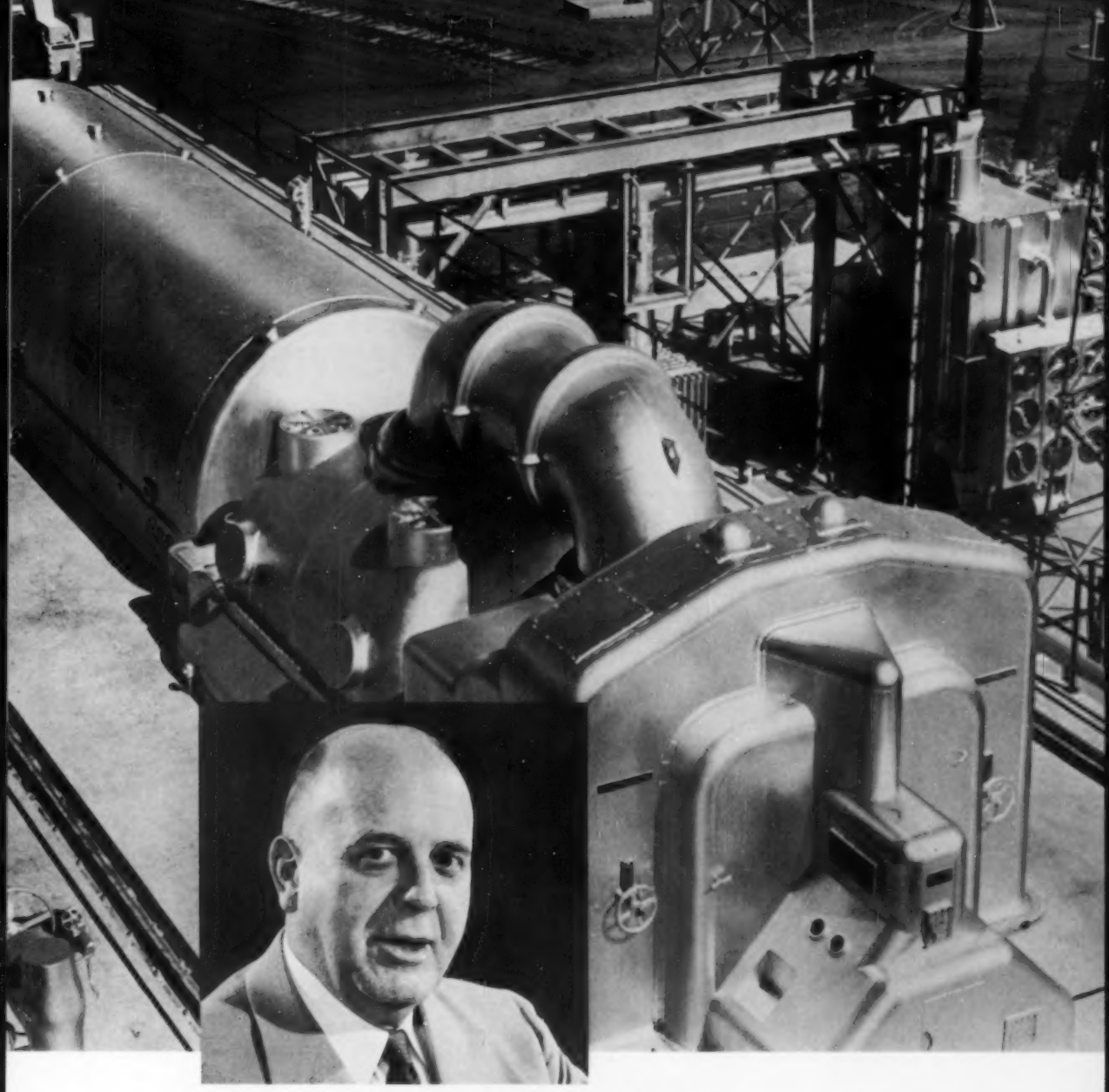
Television sets are owned by four out of five families in cities, reports the Census Bureau, but only 42% of those living in rural-farm areas have them.

In a survey made last June, the bureau found that a total 32 million United States families have TV, or more than six times the 5 million owned in 1950. Heaviest ownership is in the heavily populated Northeast and North Central regions where three-fourths of the households have sets. Other TV ownership figures by regions: In the West about two-thirds of the families have them; in the South, about one-half. Only 2% of total households in the nation were found by the survey to have two or more television receivers.

TV-Radio Outlook Rosy

Sales of television sets will reach 8 million this year for the first time in history if present sales patterns continue, says H. Leslie Hoffman, president of Radio-Electronics-Television Manufacturers Association. This would be 10% over last year's mark. He said further that radio sales would go up 9% for a '55 sales total of 12½ million sets. Prediction was made at recent luncheon sponsored by Electric League of Los Angeles.

(*More S & S on page* 197)



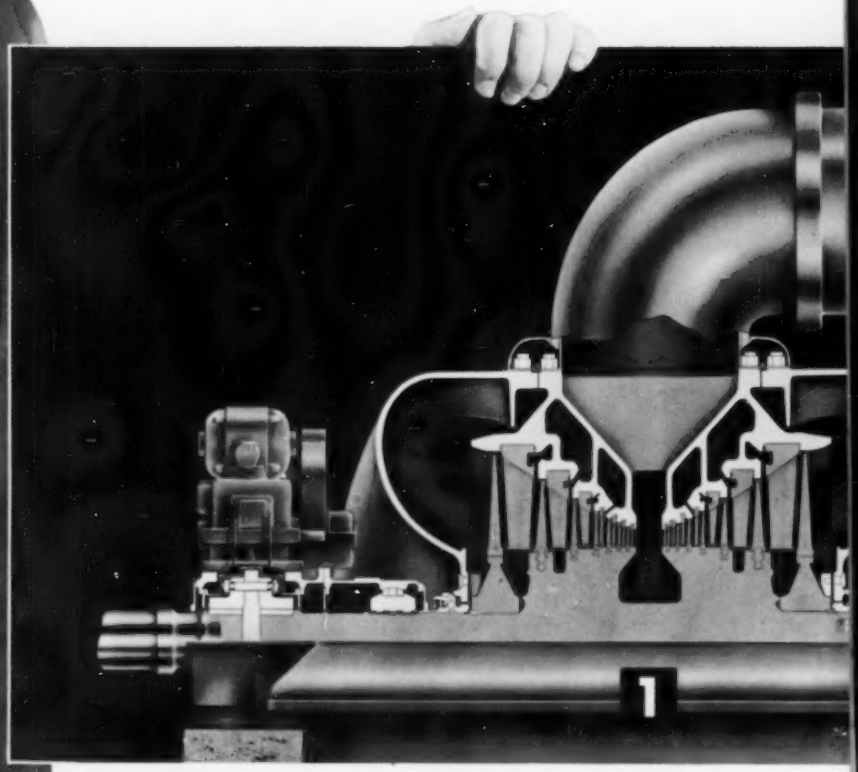
M. B. Wyman, Manager, Engineering and Service, Apparatus Division, and other Westinghouse engineers associated with him show you on the next 11 pages how . . .

"Design Extras" help you keep kilowatt costs down

YOU CAN BE **SURE**... IF IT'S Westinghouse

"L. M. Eikner (below), Sales Manager, Large Turbines, reviews four important design advances."

Exclusive design features, low thermal stresses give turbines added reliability and long-term efficiency



1. Mr. Eikner points out how Westinghouse takes extra care to assure efficiency and reliability by mounting all stationary blading on separate supports, completely free from outer casing . . . another Westinghouse exclusive.

Westinghouse turbine design and manufacture have as one major objective the maintaining of design clearances . . . making design clearances stay put! This is one way we can assure you of long-term efficiency and low maintenance. The technique: By segregating parts operating at different temperatures, the possibility of distortion during "transient temperature" conditions like start-up, load changes or partial load operation is greatly reduced. Here are four of the exclusive Westinghouse features that help do this . . .

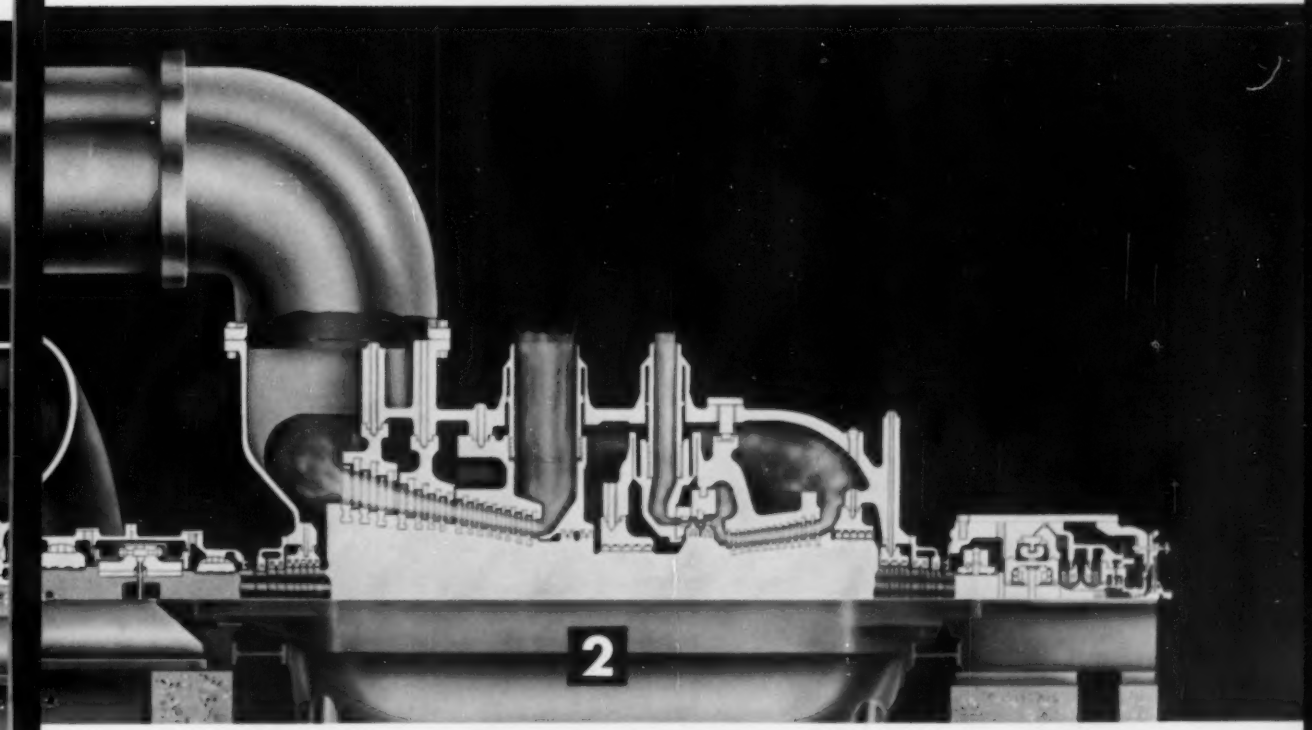
Double-wall construction insures added reliability and gives added flexibility in operation

Westinghouse turbines have separate inner casing in *both* high- and intermediate-pressure cylinders. With modern reheat turbines, this extra design feature is needed to keep thermal stresses controlled. Double-wall construction permits operation over a wider range of loading with greater assurance of reliability and long-term efficiency.

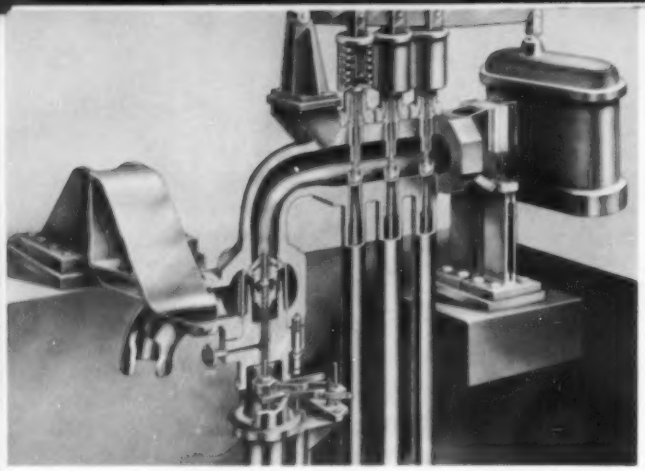
Separate blade rings in both the low- and high-pressure turbines keep efficiency high

One of the special ways Westinghouse maintains design efficiency is in the mounting of stationary low-pressure blading. Separate blade rings are designed to guide expansion and insure exact alignment of blade rings and spindle—operating clearances are maintained under all conditions. Result: Design clearances are closely held without rubbing; turbine life is longer, more efficient.

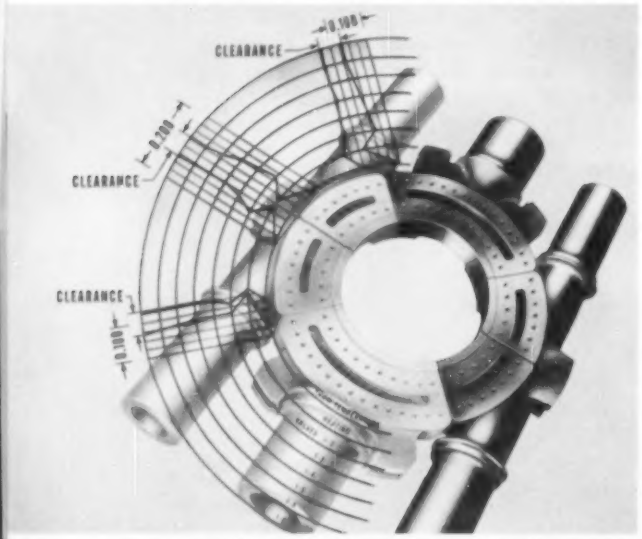
YOU CAN BE SURE...IF IT'S
Westinghouse



2. This cross section shows a modern reheat turbine with double-wall construction in both the high-pressure and intermediate casings.



Westinghouse designs steam chests completely separate from the turbine. This is an extra for high-temperature machines—and a big key to long-term, reliable operation.



This graph shows the clearance between chambers over the total load range . . . a freedom in movement possible only with separate chambers.

L. M. Eikner, Sales Manager, Large Turbines, discusses with Mr. Wyman how inner cooling of both rotor and stator significantly reduces size and weight.

Separate steam chests isolate hot steam, reduce casing stresses

Westinghouse makes *sure* that high temperature is kept from the outer casing. This is done by designing steam chests completely separate from turbine casing—isolating the high inlet temperatures. This "separate chest construction" means the outer casing is never subjected to high temperatures.

Individual nozzle chambers assure reliability at all loads

Westinghouse uses *separate* nozzle chambers for just one reason: To provide the best possible reliability, whether the turbine is running at full load, or at any partial load. Each nozzle chamber may expand without causing thermal stresses or distortion in any adjacent chamber. Result: Nozzles on Westinghouse turbines retain their original alignment for the life of the turbine.

This exclusive Westinghouse *Thermal Design* is a practical approach to give you the best possible long-term efficiency and reliability for your turbine dollar. The Steam Division calls it "built-in" quality —where efficiency is expertly designed into every part of the turbine, not just for today's conditions, but for *sustained* operation in producing kilowatts at the lowest possible cost.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

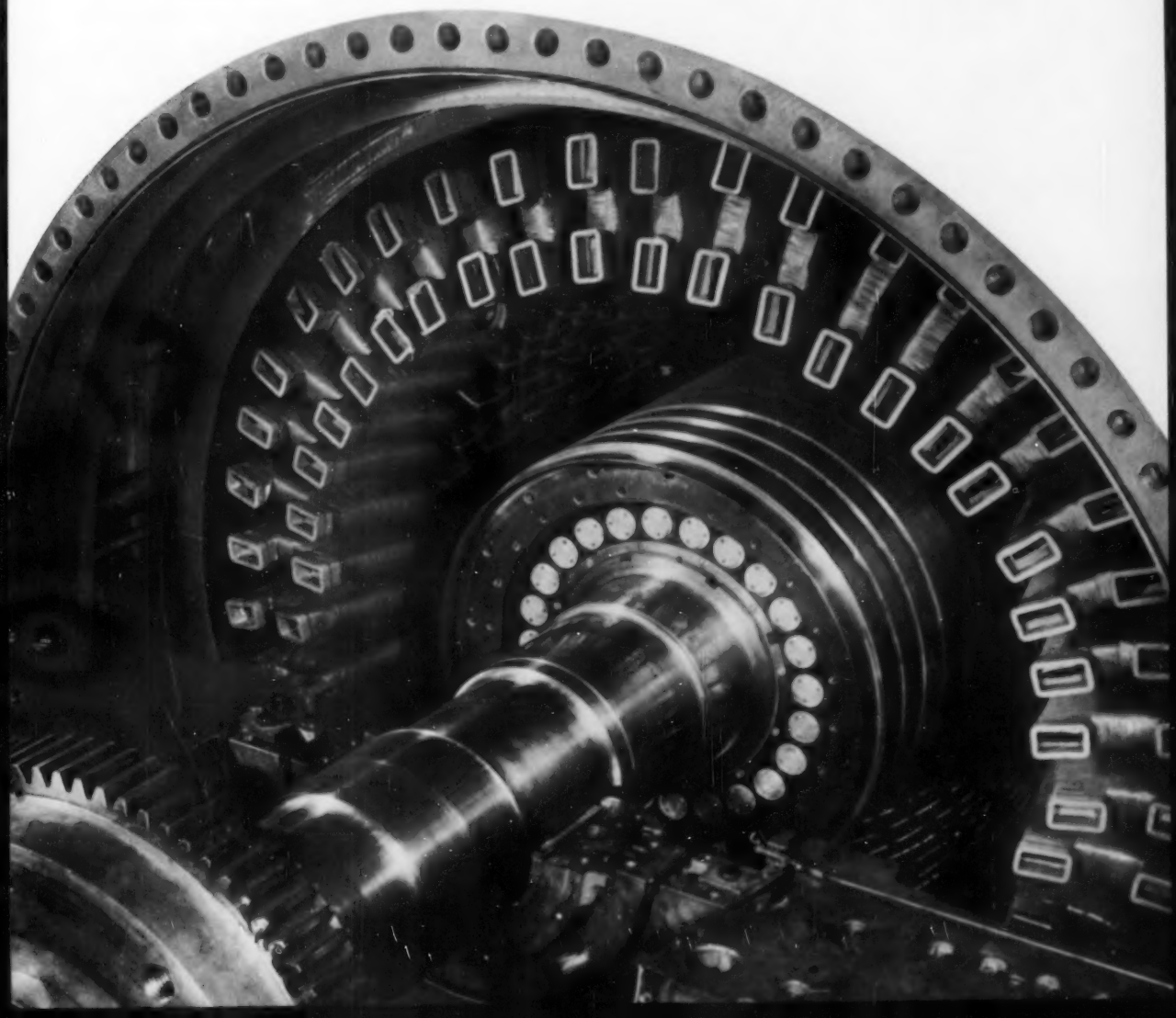
Generator capability gets big assist with Thermalastic® insulation and inner cooling

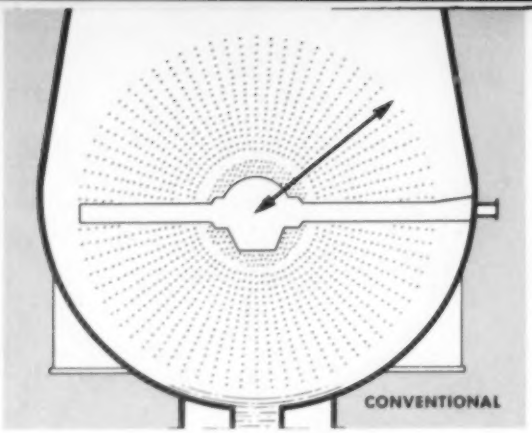
The Westinghouse method of hydrogen inner cooling is remarkably simple and effective. So effective, in fact, that output per pound of generator has been raised one-half, and single-shaft ratings over conventionally cooled units have doubled.

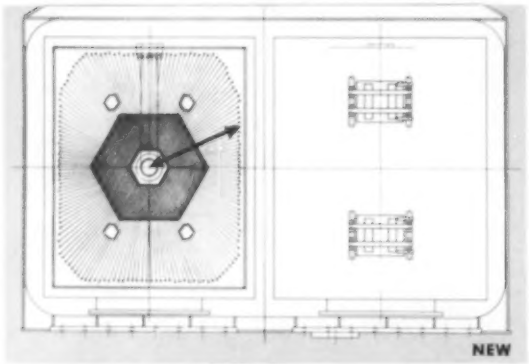
These facts are important to power production economics for any size station. First of all, this development makes possible smaller units for a given rating. Second, it raises maximum practical generator capability virtually out of sight.

Another outstanding advance is Thermalastic insulation. Among its characteristics is extreme resiliency. This means to you that heat expansion of conductors during operation will not rupture or permanently displace insulation, and that insulation will always return to its original shape when generator temperatures drop.

Clearly, here are two advances in Westinghouse generator capability that contribute importantly to holding your kilowatt cost line.







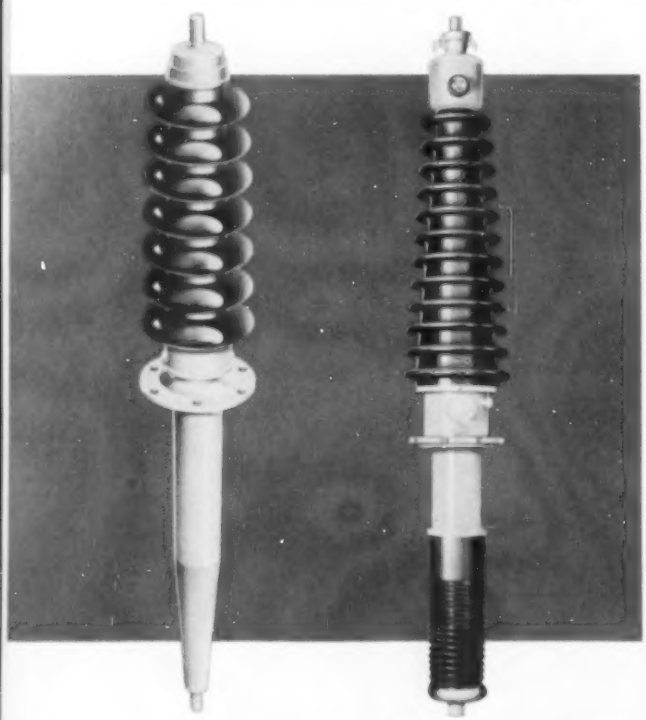
The dramatic comparison of flow-path length between conventional and new Westinghouse designs is shown here on a typical 40,000-sq. ft. condenser. This special feature makes it practical to maintain lowest possible absolute pressure.

New Twin Bank condenser improves performance, reduces headroom

This new Westinghouse design is a big advance in condenser efficiency. The Twin Bank innovation delivers very important extras . . .

- **Each tube bank has greatly reduced diameter. Steam flow path is shortened; friction drop lowered.**
- **Lower section of condenser is an extremely efficient deaerator.**
- **Headroom is cut down, installation becomes easier and more economical.**

The result: For a given amount of circulating water at a specified temperature, this *new* design will give improved performance over any other design. This is just one of the many design extras you find in Westinghouse equipment . . . extras that can reduce your costs for the life of your station.



Type S condenser bushing (left) for 23 kv through 69 kv, 400- and 1200-ampere ratings. Type O condenser bushing (right), for 92 kv through 330 kv.

Performance records prove condenser bushing reliability

The amazing service records of Westinghouse Types O and S condenser bushings illustrate how "design extras" lower the long-term cost of power equipment.

Since 1941, over 156,930 Type S bushings have been manufactured by Westinghouse and placed in service—accumulating 758,535 years of service with a 99.9834% perfect record. Starting in 1942, 33,621 Type O bushings have turned in a 99.9986% perfect record over 147,735 service years.

Reliability of this order attests the soundness of condenser construction, pioneered by Westinghouse over 50 years ago. This construction uniformly distributes voltage to prevent concentration of stress at any one point—achieves the highest mechanical strength and thermal stability of any bushing design.

Write for Booklets B-6512 and B-6401, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE **SURE**...IF IT'S

Saturation-free linear-coupler system . . . reliable, low-cost bus protection

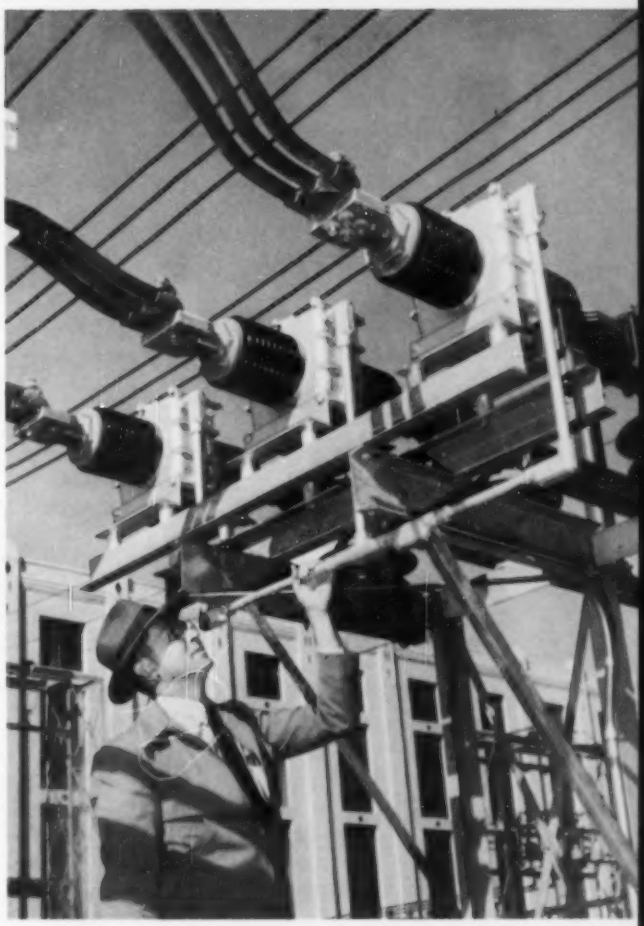
Arizona Public Service selected Westinghouse linear-coupler method for bus fault protection to reduce burnout, maintain generator synchronization . . . experienced 13 years of outstanding service. Here's why:

System expansion, plus interconnection of systems, makes it imperative that reliable, high-speed bus fault protection be provided against lightning, interference and breakdown of insulation. For this purpose, a Westinghouse linear-coupler system offers these two big advantages.

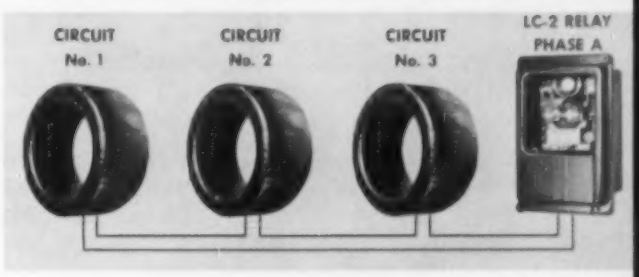
SIMPLICITY—*no saturation because there is no iron core.* Air-core transformer does not saturate, gives consistently true internal fault indication . . . assures dependable operation of relay and tripping of circuit breaker. Linear couplers may be open-circuited with complete safety without endangering personnel. Operating voltage of coupler is well within insulation limits of connected apparatus. Result: The most reliable scheme for protecting vital bus systems . . . using simple, compact, low-cost equipment.

FLEXIBILITY—design flexibility permits couplers to be applied in circuit-breaker bushing pockets, in metal-clad switchgear or on existing outdoor bus work. Coupler designs for switchgear of 15 kv through 230 kv are available.

Be sure to investigate Westinghouse linear-coupler systems for your operation.



Francis Irish, System Operations Superintendent, Arizona Public Service Company, views linear-coupler installation which provides protection of 12.5/69-kv bus.



Only one relay per phase is needed with this simple series connection. Expansion of system requiring additional couplers involves easy calculation for relay setting. Sum of voltages on coupler secondaries indicates relay setting.

Westinghouse

R. O. Bonino, Headquarters Design and Installation Engineer, reviews the record of this job.
9:45 A.M.—breaker before being lifted off the flatcar.
10:05 A.M.—breaker lowered to rollers.
11:30 A.M.—breaker being pulled across yard by truck.
2:35 P.M.—breaker ready to be bolted to pad.

$13,500 saved by installing Westinghouse factory-assembled, 3-pole breakers

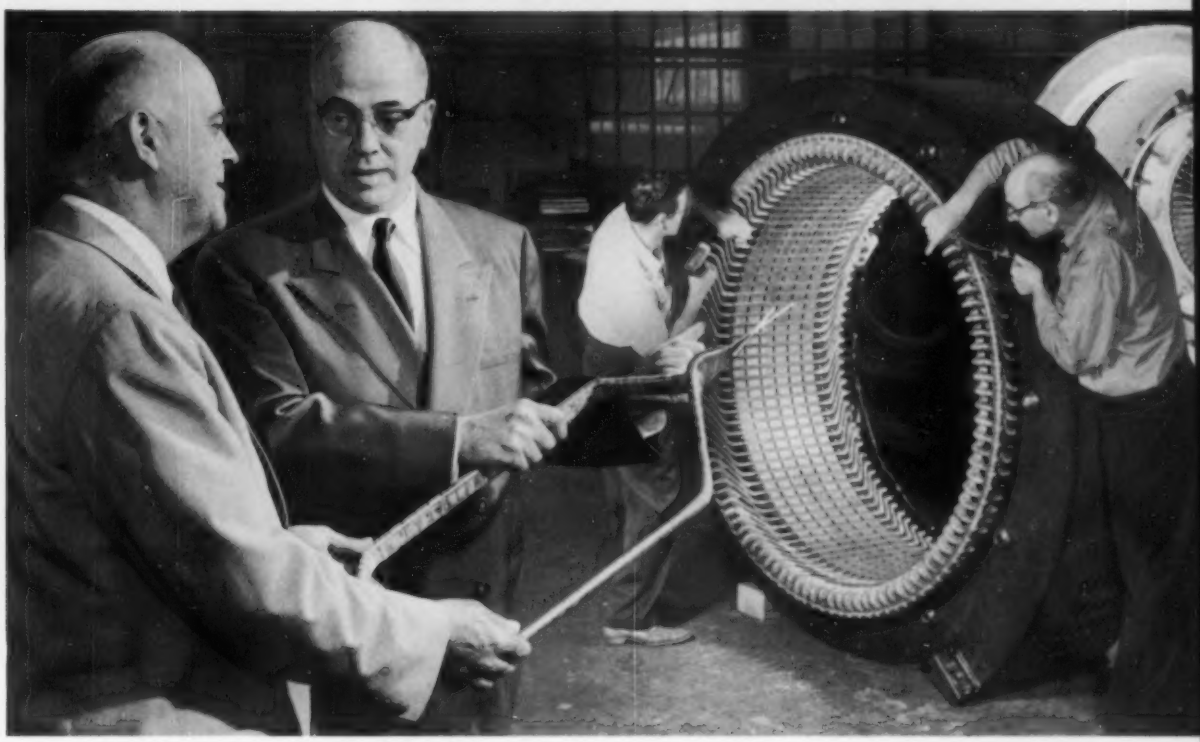
That's not a record. In fact, it is a conservative estimate by a well-known Midwestern Utility of savings realized by installing 9 Westinghouse breakers. This is an average of $1,500 per 3-pole, 138-kv breaker over 3 individual poles of conventional units . . . from flatcar to final connections.

The simple secret of such important savings is the fact that, when clearances permit, Westinghouse can ship 115- and 138-kv breakers completely assembled . . . bushings, grids and contacts set and adjusted. No on-site aligning and leveling of separate tanks.

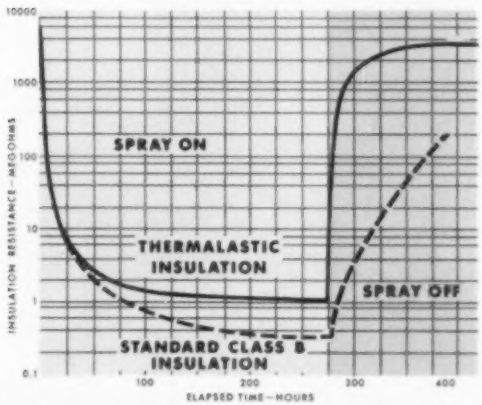
To Westinghouse design engineers, equipment investment is measured not only in first cost and reliability, but in terms of time and convenience to you.

YOU CAN BE **SURE**...IF IT'S

Thermalastic motor insulation means more protection, more reliability



C. E. Scott, Sales Manager, Large Motors, and M. B. Wyman discuss the improved performance of Westinghouse powerhouse motors.



Here are the results of a water spray test on windings of a 950-hp, 4160-volt Westinghouse motor and another motor with conventional Class B insulation. After 275 hours and 200,000 gallons of water, the superior dielectric strength of Thermalastic-insulated coils under these severe conditions proved water never penetrated the insulation.

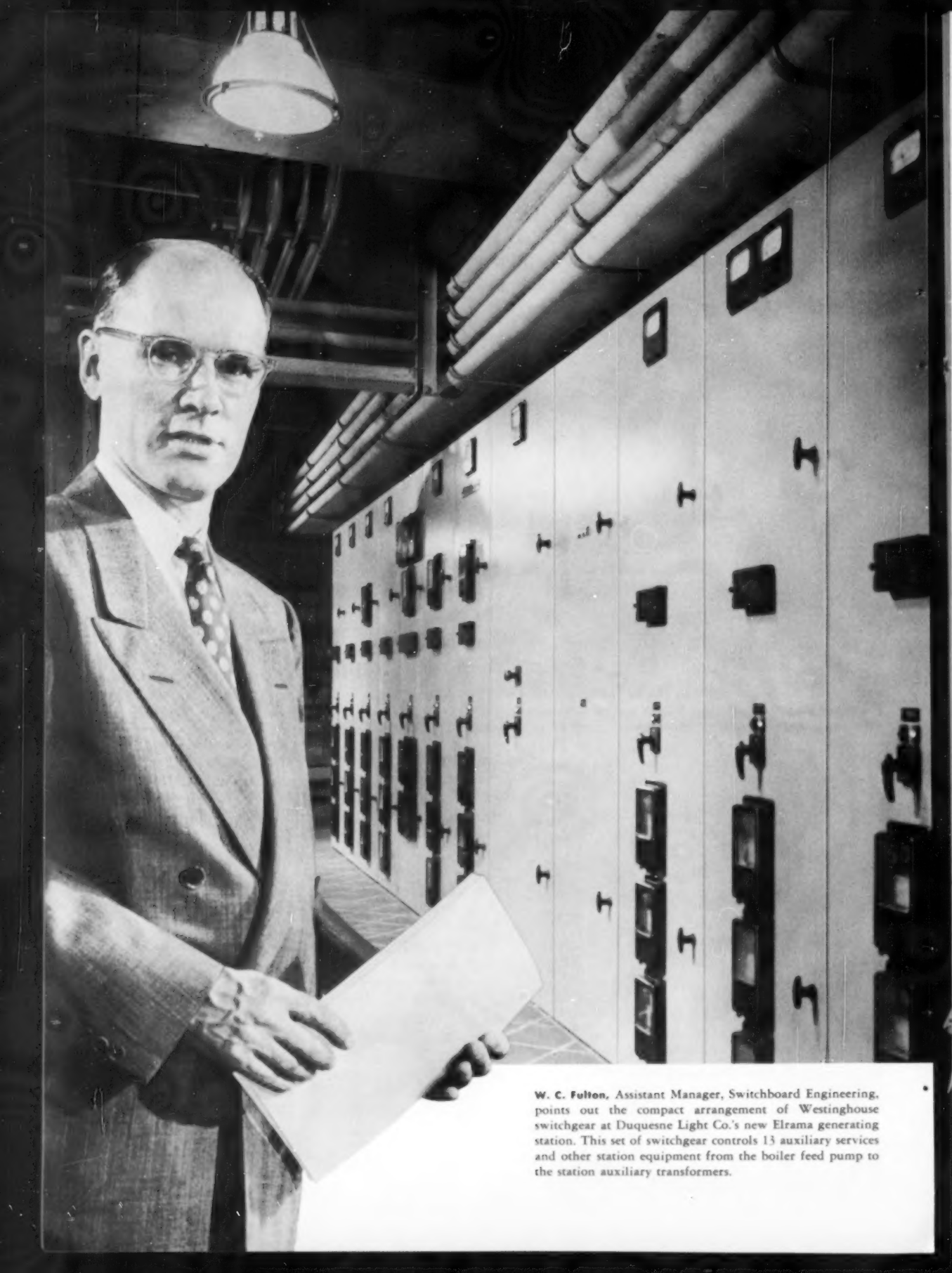
No feature of large motors developed in recent years can match Westinghouse Thermalastic insulation for the thorough protection it provides. Thermalastic is the one insulation which resists moisture, dust and other contaminants—without deteriorating in any way. Full operating ability of the motor is preserved under the most stringent conditions.

Furthermore, we have measured the new standard of performance of Thermalastic insulation in these ways: Over 20% increase in dielectric strength, 10-to-1 increase in voltage endurance, better heat transfer, greater physical strength, longer life—outstanding in every way.

Measured in job performance, no Thermalastic insulation failure has ever been reported.

In addition to superior insulation, *all* the quality built into Westinghouse powerhouse motors is assured by 26 special checks throughout the manufacturing process. There is only one objective—a more reliable motor with minimum maintenance expense.

Westinghouse



W. C. Fulton, Assistant Manager, Switchboard Engineering, points out the compact arrangement of Westinghouse switchgear at Duquesne Light Co.'s new Elrama generating station. This set of switchgear controls 13 auxiliary services and other station equipment from the boiler feed pump to the station auxiliary transformers.

"W. C. Fulton, at the left, is one of the men who have taken the hard work and extra expense out of your switchgear planning, ordering and setting up."

Standardized design means you get on the line faster . . . more equipment for your switchgear dollar

Here's how. First, you get more equipment for the money. With a sound, universal metal-clad switchgear design, together with standard assemblies and planned production methods, Westinghouse is able to give you a better product at a lower price.

Second, standardization means no special engineering—it has all been done before you place an order. Your project layouts, equipment specifications and ordering procedures are all simpler, surer, faster. The result: Time and money savings.

Uniform design and construction of Westinghouse standardized switchgear lend themselves admirably to the next step—complete factory assembled within shipping limits. Factory assembled switchgear comes to you wired and thoroughly tested. Uniform conduit and foundation layouts can be planned in advance of shipment. Mount, connect main and control circuits, and you're on-line. At any later date, the switchgear may be expanded, rearranged or relocated by units.

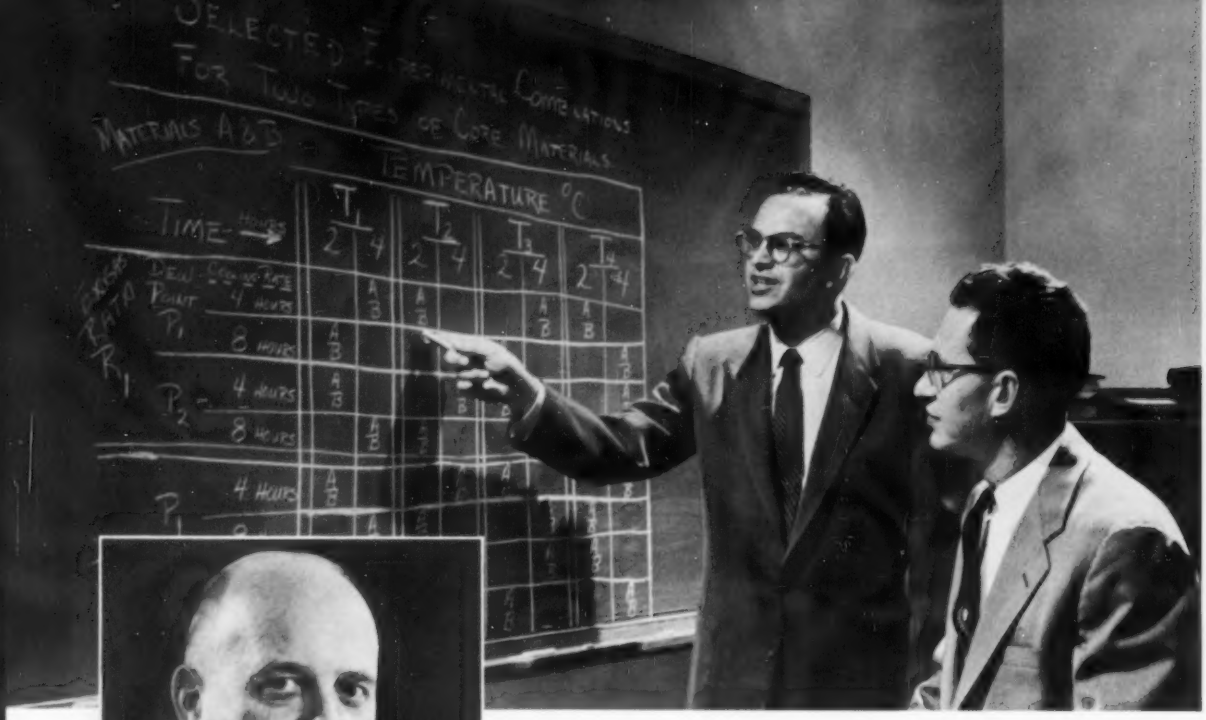
Here is a story of straight-line economy in Westinghouse switchgear that can't be beat.

Scrupulous attention has been paid to easing problems of power station auxiliary expansion, inspection and maintenance. Here replacement of a DH breaker is demonstrated —fast, no problem.

With an expert "mix" of design engineering, volume production and factory-controlled assembly, Westinghouse is able to offer you standardized switchgear for any usual application at lower installed cost.

YOU CAN BE **SURE**...IF IT'S

Westinghouse



The setting up and discussion of problems, such as this, in the early stages of product or material development remove needless guesswork and some experimentation. Recent and notable advances to emerge from Materials Engineering include improved turbine blades, retaining rings and semiconductors.

Materials Engineering shortens the distance between ideas and products

Here is where product ideas originating in research . . . or, for that matter, anywhere within the company from sales to design engineering . . . receive their first commercial direction. This unique industrial facility combines the roles of experimenter and statistician. Whether the project under consideration is a product, a process or a material, the purpose of this department is to design out the blind alleys of conventional development work. Its technique is primarily statistical; its tools, all that science can provide . . . from electron microscopes to pilot production apparatus.

Huge laboratories house hundreds of engineers, scientists, mathematicians. High-temperature lubrication, powdered metallurgy, ultrasonics are a few of the fields of development which keep Materials Engineering busy in ways which are profitable now and promising for the future.

To Westinghouse, Materials Engineering is a valued engineering catalyst, combining applied research, production know-how and market insight. To you it means . . . better materials, better products, better electrical systems.

• • •

The Man With The Facts

For complete data on power station apparatus described in these pages, call The Man With The Facts, your Westinghouse Sales Engineer; or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S Westinghouse

CP-1033

Electricity vs Gas

Natural gas is on its way, but Seattle customers continue to go all-electric

Seattle City Light's program to convert more of its customers to an all-electric rate continues to meet with success, despite the expected entry of natural gas into the area next year.

The utility allows a $55 credit to home-owners switching to electric ranges and automatic electric water heaters. During the first seven months this year, 1,118 electric ranges and 1,360 automatic electric water heaters were installed under this program, enabling 1,428 customers to switch from the standard to a lower all-electric rate. In the same period last year, 1,198 customers converted to the all-electric rate.

Total number of all-electric accounts in Seattle now exceeds 130,000, about 67% of the total number of residential customers, according to Commercial Manager Cliff Tyler. New construction is declared to be approximately 98% all-electric.

In the commercial field, things are moving well, too. The month of July saw a new load of 439 kw in commercial cooking and 168 kw in water heating. Air conditioning of stores and buildings added 86 hp.

North of Seattle, the Snohomish County PUD—largest PUD in the state—added its 50,000th customer, 1,350 new installations having been made since the first of the year. Its sales for the year ended June 30 were 27.7% above the previous 12 months.

Meanwhile, the Cascade Natural Gas Corp announced plans to spend at least $10 million on the construction of new gas distribution systems by mid-1956.

Pills or Blankets?

"Don't Reach for Sleeping Pills, Reach for Your Electric Blanket" trumpets ads in a fall electric bed covering promotion sponsored by San Diego Bureau of Home Appliances. Unusual approach was developed by bureau after consulting medical authorities who want to call public attention to dangers of sleeping pill habit.

(*More S & S on page* 199)

How to have clear telephone service... even in the middle of the proverbial "BOILER FACTORY"!

GAI-PHONE (pronounced GUY-phone) ... *the wonderful new electronic telephone for noisy areas*

EVER TRY to talk to your chief engineer while he checked meters at a generator? Or to your production manager while your biggest and noisiest machinery ran full-blast? Such a situation *could* be no problem at all, if your man were talking to you on a GAI-PHONE.

This ingenious electronic telephone—using some vacuum tubes, rectifiers and other devices in its special base—actually creates a *Zone of Quiet* around the user's head. His voice comes through clear as a bell, but the extraneous noise is effectively suppressed. What's more, he can adjust *his* telephone so that your conversation is clearer and the annoyance of side-tone is reduced.

Best of all—it's all much less expensive than building sound-proof booths or such. Let us tell you more—send coupon today.

STROMBERG-CARLSON® COMPANY

ROCHESTER 3, N.Y. • A DIVISION OF GENERAL DYNAMICS CORPORATION

Please let us have more information on your GAI-PHONES, for use in noisy areas.

FIRM .....

ADDRESS .....

.....

SIGNED .....

99.6% SURE
His health depends on continuous electric power . . . on the farm, in the dairy, in the home . . . to assure proper pasteurization and refrigeration of his milk. That's where C-D's field-proved dependability pays off . . . regardless of changing weather or power load conditions. The thousands of C-D power capacitor installations . . . all with records of 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in contributing to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement

CORNELL-DUBILIER
power-factor
capacitors
give you better than 99.6%
trouble-free service*

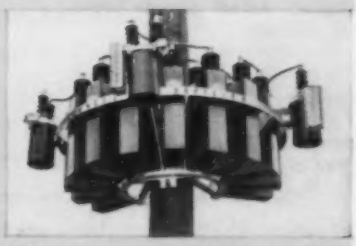
Lowest volts per mil unit stress results in the extra margin of safety necessary to withstand all system high voltage transients. This lower volts per mil and lower volts per section feature is the utility's assurance of extra longevity in its capacitor purchase when Cornell-Dubilier's are specified.

Only C-D power capacitors are subjected to a full-rated voltage energization test. C-D removes potential trouble-makers before they get on your poles . . . not after with costly replacements.

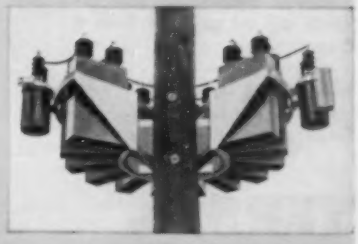
Lowest unit dielectric stress not only provides lowest voltage gradient for steady state operating conditions, but also highest withstand protection against the transients produced by lightning, circuit breaker re-strikes and all other line surges.

Heavy major insulation in the form of laminated liners, with reinforced corners insures highest impulse withstand levels. It means, too, a heavier capacitor unit . . . because it's a better unit . . . but at no extra cost to you. How would you relate a slight increase in weight to years of trouble-free service?

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.



C-D's new semi-round pole mounting Contour Capacitor® Rack.



***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**

Closing a Sale

Salesmen can learn how by doing it themselves with new kit of EEI training films

Salesmen learn how to close a sale by doing it themselves in a new sales training film just released by Edison Electric Institute. The film was prepared by EEI's Sales Training Committee to give electric appliance salesmen selling experience, even before they meet the public.

The film set utilizes a technique called "Repetitive Impact Training". This is a continuous 16mm loop film which allows the story to be repeated over and over until the trainee grasps the situation. A second film lets the trainee assume the role of the salesman in the same situation. It too repeats itself until the trainee establishes confidence in himself in closing the sale.

Value of this method, says EEI, is: 1. It gives trainees experience before they meet the public; 2. It shows them how to ask the customer to sign on the dotted line.

Besides the two films, the set includes a training manual, an adapter arm and a portable screen. The loop film and the adapter can be used with any 16mm sound motion picture projector.

This sales training package sells for $160, (10% additional to EEI non-members). Additional sets are $100 each. The kit is offered on a 10-day free trial basis.

Wisconsin P&L Goes to Wire-on-Time Plan

A "Wire On Time" plan has been launched by the Wisconsin Power & Light Co in two of its operating districts. After a trial run it expects to extend the plan into all of its operating territory.

Plan provides for no down payment for jobs up to $360; a maximum of 36 months to pay; minimum payments of $5 a month; and a carrying charge of ½% per month. Credit must be approved. Home owners or owners and tenants may sign the time payment contract.

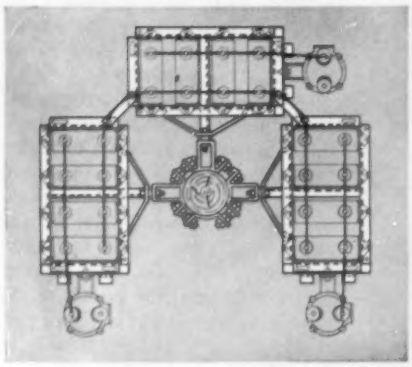
The customer chooses his electrical contractor. The contractor does the work and handles arrangements for the

HANGING CAPACITORS WITH

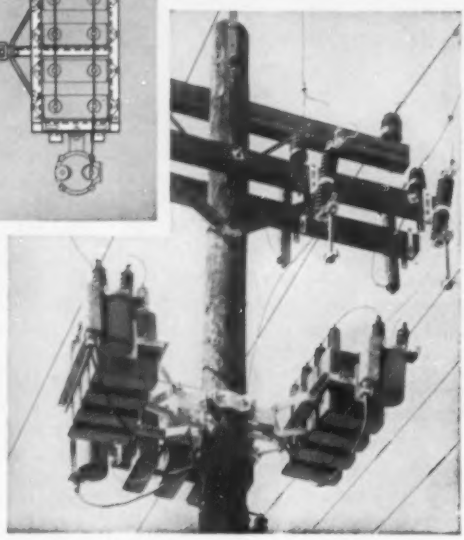
UNIVERSAL CAPACITOR RACKS

SAVES UP TO *40%*

INSTALLATION COSTS



With Universal Racks you simplify hanging capacitors . . . Actual labor time greatly reduced by ground assembly and eliminates gaining the pole—drilling holes — excessive material handling.



NO OTHER HANGING METHOD HAS ALL THESE ADVANTAGES

LOWER COST — per overall installation. Actual records prove saving up to 40% over conventional methods.

NO MAINTENANCE — All parts hot dipped galvanized to most rigid A.S.T.M. specifications. Capacitor racks will outlast pole.

LESS POLE SPACE REQUIRED — Allows multiple units to be installed on one pole. All points on top of—alongside—and under capacitors easily accessible.

BETTER WEIGHT DISTRIBUTION — Prevents buckling and/or drifting of the pole. Stronger installations.

VERSATILE — Will mount either standard distribution size capacitor groups. Universal Pole Brackets will fit any pole from 6 to 10½ inches or 9½ to 14 inches in diameter.

There are other advantages to be found in using Universal Pole Brackets and Universal Capacitor Racks. Write now for free catalogue or request us to send a representative to see you. No obligation, of course.

UNIVERSAL
POLE BRACKET CORP.
P. O. BOX 1118—HOUSTON 1, TEXAS

time payments. Wisconsin Power & Light Co pays the contractor. The customer makes his payments on his monthly electric bill.

Meanwhile, electrical contractors in Sheboygan, Wis., are outlining a campaign to eliminate the winter slump in their business. Workmen will go out and ring door bells and solicit wiring modernization jobs. These men will be the same ones to do the work. It's their hope that the solicitations will keep business at a normal level through the winter.

S&S SHORTS

Prices: Some Up, Some Down

Parade gets longer of appliance and radio-TV manufacturers who are raising prices. Both Philco Corp and Allen B. Du Mont Laboratories, Inc. have put higher price tags on their television sets and Westinghouse Electric Corp hiked its pop-up toaster and combination grill and waffle iron. Meanwhile Kelvinator division of American Motors Corp reduced four home laundry appliances in its 1956 line from $10 to $32.

Cheaper Color TV in Offing?

Westinghouse Electric Corp has developed a 22-in. all-glass, rectangular color television picture tube. Said to be the first color unit built like a conventional black and white tube, its maker claims it "introduces engineering techniques which open the way to reduced bulb costs."

Lighting Vocabulary Urged

Thirteenth session of International Commission of Illumination held in Zurich, Switzerland last June has presented three recommendations for confirmation at an October meeting of the U. S. Committee, including publication next year of an international lighting vocabulary defining terms in at least three languages.

Shorties

Still another manufacturer, Duro-Test Corp, has announced production of the new pink-type incandescent bulb . . . New York's Hotel Governor Clinton has placed color television sets in 50 of its guest rooms, the nation's first substantial installation of color TV according to Radio Corp of America.

When DISASTER STRIKES

PORCELAIN PRODUCTS' STRATEGICALLY LOCATED REGIONAL STOCKS ASSURE IMMEDIATE DELIVERY

New England Electric System and other New England utilities restored service swiftly with aid of Porcelain Products' Boston stocks.

Hazel, Connie, Ione, Janet spell disaster!

Any disaster that affects loss of communication and power over a widespread area is of national import, and a minimum of delay in the restoration of service is of prime consideration.

Porcelain Products insulators and allied materials are strategically located on a regional coast-to-coast basis and are immediately available.

Know your source of supply now and save valuable time in future needs.

Quality you can trust

60 years

YOUR INDEPENDENT INSULATOR MANUFACTURER

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

PP INC.

Export Representative: Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.

Facts from **ANACONDA**—Pioneer in Butyl Insulation

FROM SERVICE RECORDS

FROM TESTS—

Here's proof you get

GREATER OZONE RESISTANCE

MORE AMPS PER DOLLAR . . . with

ANACONDA BUTYL RUBBER HIGH-VOLTAGE INSULATION

Millions of feet of Anaconda Type AB butyl-insulated cable in use. A new series of tests giving comparative performance data. Tests that demonstrate qualities that make for long life, low over-all cost. All these prove the clear superiority of Type AB.

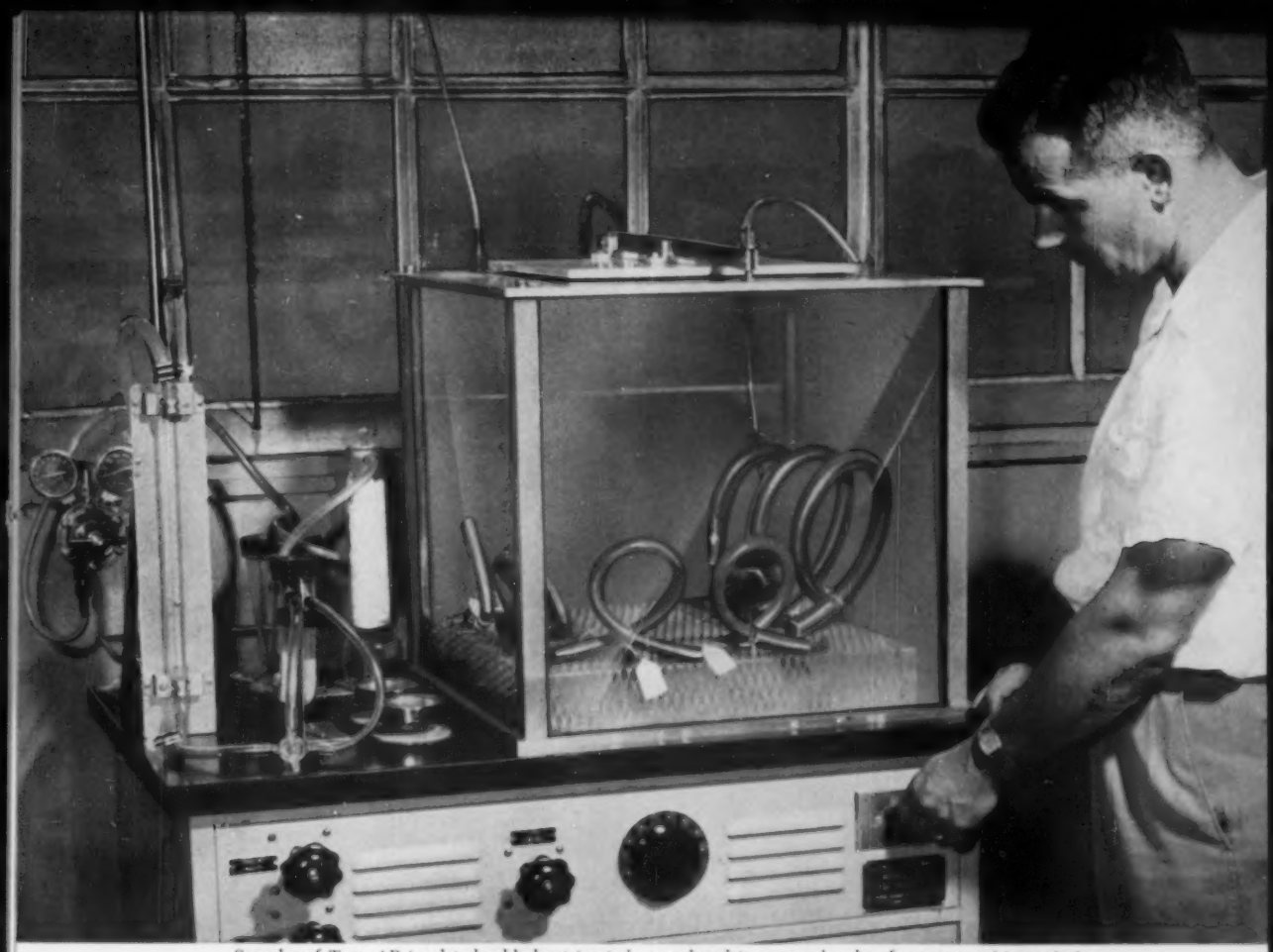
Here are actual figures you can use to judge the relative performance of high-voltage cables.

These are part of an exhaustive series of tests that clearly show Anaconda Type AB butyl insulation gives performance *far beyond* industry specification standards—in every important electrical and physical property.

Butyl rubber has *inherent* high resistance to ozone, heat and moisture. Thus compounding efforts ordinarily spent to obtain these qualities have been devoted to the development of other desirable properties.

Anaconda — in 1945 — was the *first* to make and offer a high-voltage cable with butyl insulation. Since then it has supplied millions of feet of this cable to utilities and industrials.

Read the next 3 pages for first-time facts and figures vital to your buying decision.



Samples of Type AB-insulated cable bent in circle are placed in ozone chamber for ozone-resistance test.

Anaconda Type AB resists ozone cutting best—Tested 72 hours in ozone chamber without failure

FAR LONGER THAN NEEDED TO PROVE ITS HIGH OZONE RESISTANCE!

Ozone resistance is one of the more important tests on high-voltage cable. For ozone—generated by the breakdown of air under high electrical stress—is a tough enemy of cable at 2,001 volts and up. This active form of oxygen attacks ordinary rubber insulation . . . causing cuts and cracks that mean early cable failure.

Surpassing the standard industry specification test of three hours, Anaconda Type AB butyl showed no injury after *72 hours* in 0.026-0.030% ozone concentration . . . *24 times longer* than butyl specification requirements at the same concentration, and *24 times longer* than required in oil base specifications at a lower concentration. Type AB withstood 72 hours' exposure *after aging* without evidence of damage. This is positive proof of the added margin of protection obtained with Type AB.

Results of oxygen-pressure tests also show clearly the superiority of Type AB insulation in resistance to oxidation aging—tensile strength and elongation retain high values slightly below initial.

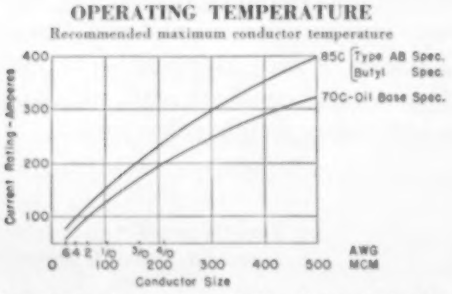
Turn the page for more data on Anaconda Type AB insulation

Facts from **ANACONDA**—Pioneer in Butyl Insulation

KELVIN DOUBLE BRIDGE is used by laboratory technician to measure d-c resistance of cables. This accurate method of determining conductor temperature assures reliable results.

COMBINATION MANUAL AND AUTOMATIC switchboard is used for control of the constant-temperature room for testing cables—from very cold to very hot. Such modern equipment makes Anaconda's research and testing facilities the finest in the industry.

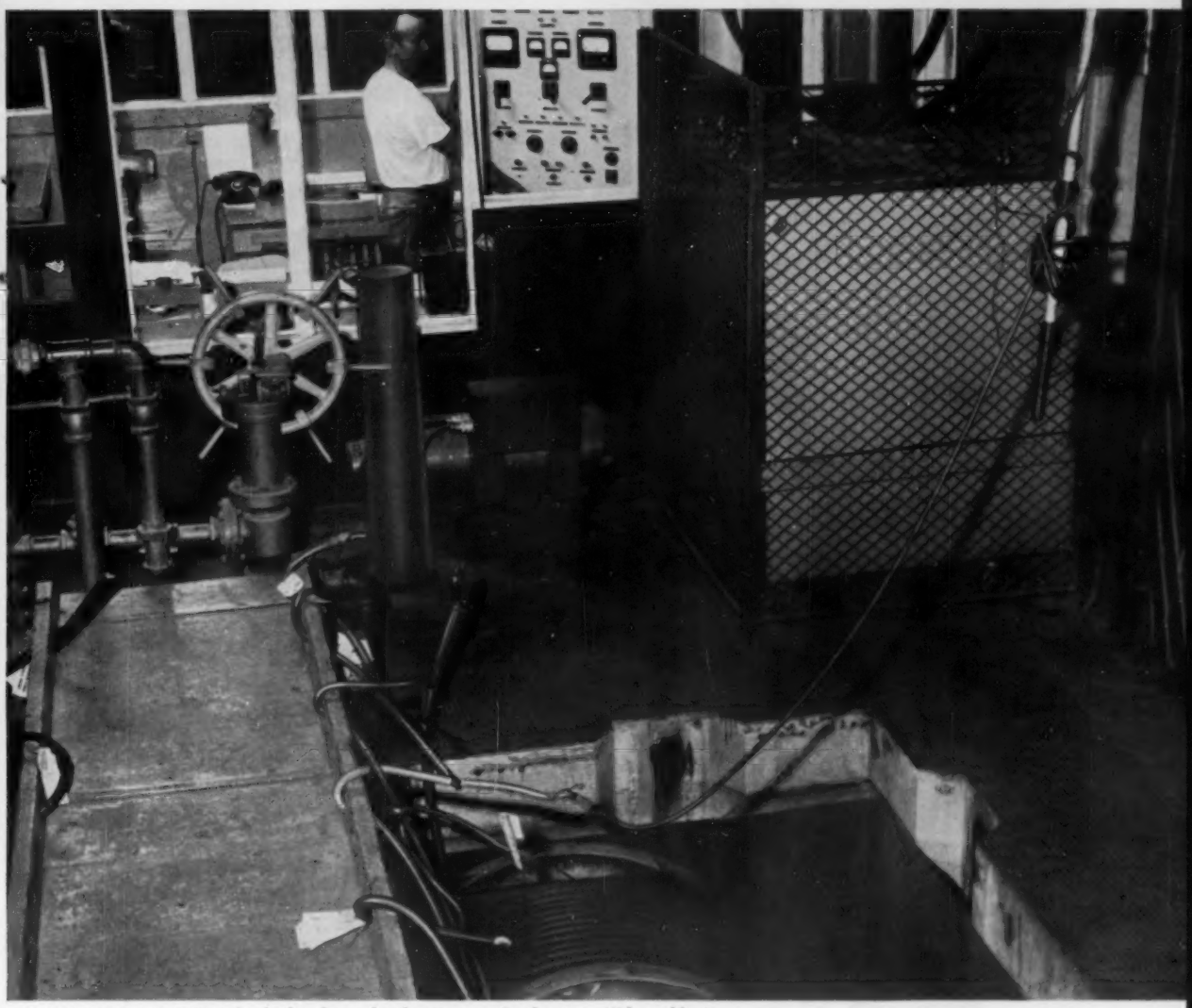
Anaconda Type AB has 22% more current-carrying capacity. Recommended for operation at 85C!



Current ratings based on 3-1/c, 15-KV, rubber insulated cables in one conduit, 100% load factor, 40C ambient temperature.

Severe physical and electrical tests for long life and stability back Anaconda's recommendation of Type AB butyl insulation for *operation at 85C maximum operating temperature.* Industry specifications recommend 70C for oil base. Thus, the curves on the chart show Type AB's current-carrying capacity advantage is 22% over oil base. With Type AB-insulated power cables, users can now carry more current per circuit!

To give added assurance of peak performance — Anaconda sets voltage tests high



TESTER ADJUSTS CONTROLS for high-voltage d-c factory test. In this test, 15-kv cable is subjected to 106 kv for a full 15 minutes. This voltage is 33% above industry requirements.

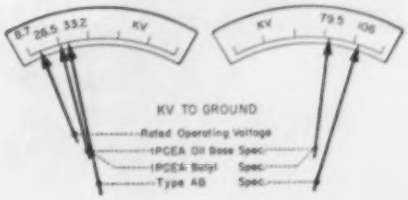
The high-voltage factory test is made with both a-c and d-c on every reel of cable. To make sure it has highest quality, Type AB is tested at 25% above industry requirements with a-c, and 33% above industry requirements with d-c.

FOR COMPLETE INFORMATION on the full series of tests, see your nearest Anaconda Wire & Cable Company representative; or write 25 Broadway, New York 4, N. Y.

HIGH-VOLTAGE FACTORY TEST

SPEC: After 6 hours' immersion

A-C—5 Min **D-C—15 Min**



Ask the Man from ANACONDA® **PIONEER IN BUTYL INSULATION**

NEW EQUIPMENT

Utility Truck

Mounting the post hole digger and derrick on the front of this utility line truck is reported to facilitate maneuvering the truck into position at job locations. This feature also gives the driver complete visual control while operating the digger or derrick from inside the cab.

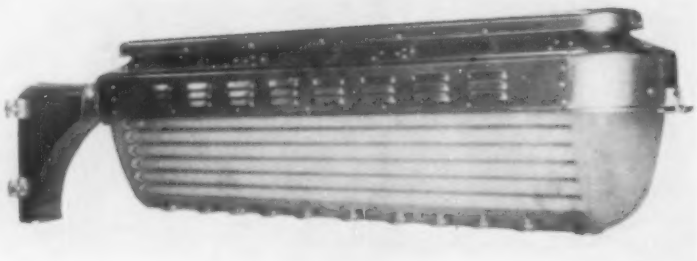
The Model U-150 "Rhino," as it is designated, is fitted with a line body for carrying tools and equipment. It has a driving front axle rated at 9,500 lb, a GVW of 14,500 lb and two standard SAE large power takeoff openings. **Four Wheel Drive Auto Co, Clintonville, Wis.**

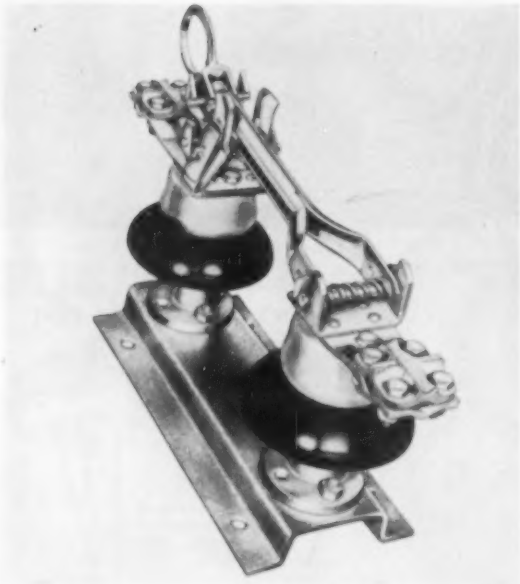
Fluorescent Luminaire

This fluorescent luminaire with 12, 6-ft Rapid Start lamps is designed for use on wide urban thoroughfares. It generates more than 64,000 lumens.

Cooling air is drawn in through the bottom of the globe and openings near the lamp ballasts, and exhausted through top vents. All openings are covered with fine-mesh screens or perforated metal.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.





Outdoor Disconnect Switch

This 1,200-amp, hook-stick, disconnect switch (Type PES) is a single-blade, single-throw, switch designed for sectionalizing, disconnecting or bypassing applications. It is rated for voltages from 7.5 to 69 kv.

Switch features include an extruded tubular switch blade with a heavy section of back-up copper to provide extra strength and greater thermal capacity, adjustable terminal clamps that accommodate a wide range of conductor sizes, a minimum of current interchange points, and a positive blade lock-in and pry-out device. It can be either pole or structure mounted in a vertical or inverted position.

These features are also found in the 400 and 600-amp switches already available in the PES line for the same voltages.

Line Material Co, Milwaukee 1, Wis.

(*More New Equipment on page* 208)

Accidents reduced...costs cut...with HAPCO Aluminum Standards

When Hapco Standards are installed, there's real reason for civic pride. Not only do they last longer, they look better longer because their silver gray surface is resistant to virtually all atmospheric conditions. Furthermore they require no maintenance so that the investment in Hapco Aluminum Standards guarantees minimum overall lighting cost. For proof that "Aluminum costs less," write the Hapco Engineering Department.

What's more, their high visibility helps reduce accidents.

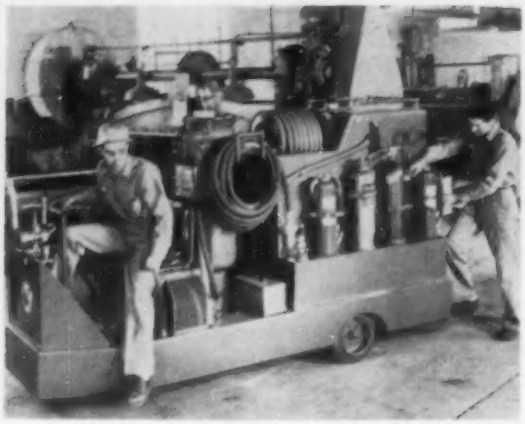
Hapco Aluminum Poles are sturdy enough for the heaviest duty, yet they maintain harmonious beauty with their surroundings. All Hapco Standards are Venetian column type, acclaimed by architects for eye appeal and strength. For street lighting, for traffic control lighting, for area flood lighting, these Hapco Aluminum Alloy Standards allow you the widest possible choice in fine lighting equipment.

Be sure to call your Hubbard representative for assistance in specifying lighting standards, traffic signal pedestals, flood lighting standards, and related equipment. You can order Hapco products through more than 200 leading electrical distributors throughout the United States.

FREE HAPCO Catalog

If you'd like more details on design features and specifications of the complete Hapco line, write for this new free catalog. It contains valuable information to help you plan the most efficient, most beautiful highway and street lighting, as well as any other outdoor lighting requirement. (Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pa.)

HUBBARD ALUMINUM PRODUCTS COMPANY
Division of Hubbard & Company
Pittsburgh 1, Pa.



Plant Fire Trucks

A line of easily maneuverable in-plant fire trucks has been designed to carry a wide assortment of fire fighting equipment.

Trucks are offered in six basic models. The KB 8 Model features a 300-lb dry chemical unit with 100 ft of hose backed up by a 150-gal water fog system driven through a power take-off. Other units utilize dry chemical-carbon dioxide combinations, water fog-carbon dioxide combinations or plain water. An accessory cabinet on the truck provides storage room for additional equipment.

Units are offered on either a three-wheeled 42-in. wide chassis for indoor use or a four-wheeled 48-in. chassis for indoor-outdoor use.

Ansul Chemical Co, Marinette, Wis.

Voltage Controls

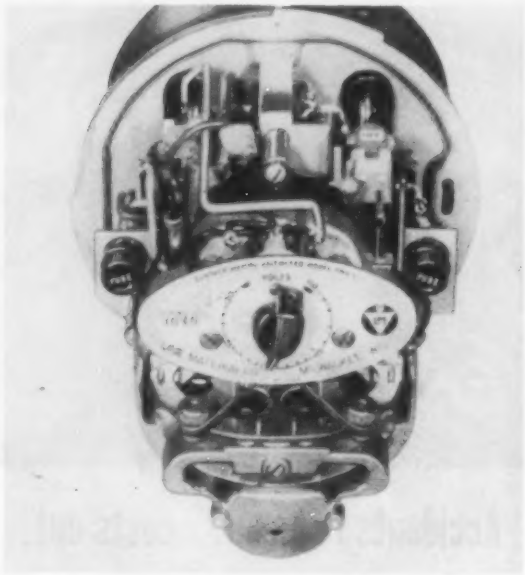
Socket-mounted voltage controls are designed to actuate oil switches for capacitor bank switching. They incorporate an induction disc-type contact making voltmeter and are said to require very little maintenance.

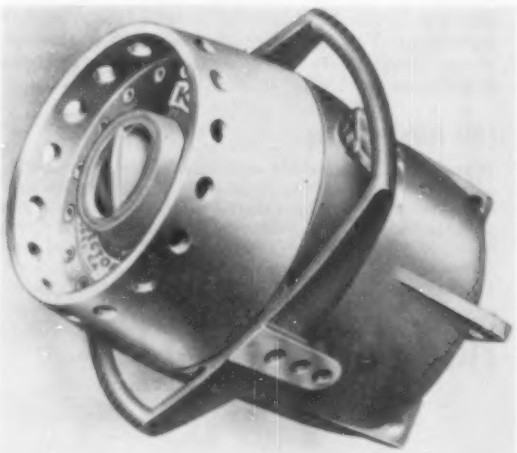
Controls have an adjustable band width from 1½ to 12 v and an operating range from 110 to 130 v. Voltage level is adjusted by turning the voltage adjustment to the desired value indicated on the dial. Positive time delay is reported to provide a time factor unaffected by temperature, fatigue, dirt, dust, moisture or corrosion.

Load contacts are rated for 20 amp. One fuse is provided for the load circuit and another for the control circuit. A lightning arrester is included as standard equipment.

Voltmeter is temperature compensated to hold an accuracy of +1% in ambient temperatures from −31 F to 140 F.

Line Material Co, Milwaukee 1, Wis.





Gamma Ray Projector

A portable gamma ray projector is being offered for radiography on large diameter, heavy walled pressure vessels, and for heavy fillet and butt weld assemblies.

These units are shielded with lead, the thickness of which depends on the strength of the isotope used. To operate the device, a lensless shutter is used. This can be opened and closed remotely. The projectors are said to be safe to operate and require no maintenance beyond replacement of the isotope. They are capable of taking a 360 deg picture.

Gamma ray projectors are available in three sizes weighing 75, 250 and 2,900 lb (illustrated).

M. W. Kellog Co, 225 Broadway, New York, N. Y.

Right off your Square D Distributor's shelf!

New QMB Saflex Distribution Panelboard

Exactly the Power Panelboard you want—when you want it. Your Square D Distributor stocks boxes, interiors and plug-in units which can be quickly assembled to meet virtually any specifications. Above, interior ready for easy mounting in box.

Plug-in Units are installed easily on tubular bus bars. The solid neutral can be changed in minutes. Here is flexibility that reduces "down time" and saves money.

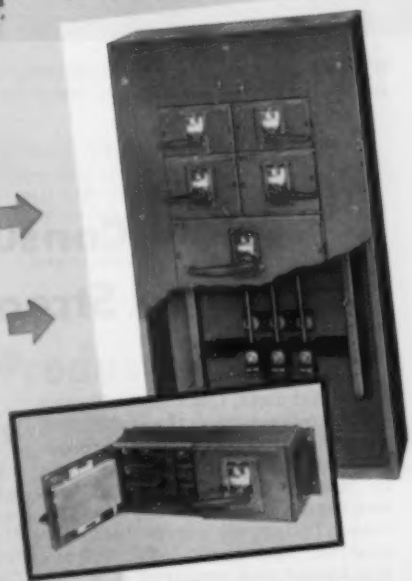
Three Simple Assembly Steps Fronts, with adjustable trim clamps, are available with or without doors.

With ALL these Quality Features

INTERIORS are flexible and adaptable to almost any service and voltage. Plug-in units and solid neutral can be changed simply and quickly.

BOXES provide generous wiring space.
FRONTS furnished with or without doors have adjustable trim clamps.

UNITS have quick-make, quick-break switch mechanism, visible blades and are horsepower rated. 30, 60, 100 and 200 ampere units are plug-in, while 400 and 600 ampere units are bolted to the bus.

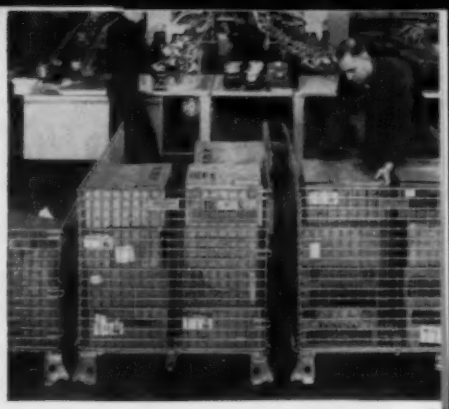


•*Underwriters' Approved for Service Entrance*

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

By using Cargotainers in collection, storage, processing and redistribution of gas and electric meters, here's . . .



Fold-away ends on Cargotainers make meters easily available to operators of efficient automatic equipment such as this for testing gas meters.

Centralization of test and repair operations for electric meters has speeded production, increased scientific accuracy and enabled standardization of methods.

How Consumers Power Saved Costs By Streamlining Meter Service

Until last year, Consumers Power Company serviced the 1,220,000 gas and electric meters through which it serves a 64-county area in Michigan at 16 different test centers scattered across the state. Today, all except large industrial and commercial meters are tested and repaired in a single new General Meter Building at Jackson.

To keep each meter regulated to scientific clock-like precision, it is replaced periodically and brought in for testing, repair, and adjustment. Frequency of this service cycle is determined by the amount of energy being metered.

Formerly, each meter arriving at one of the test centers was unloaded individually, tested and repaired, manually placed in space-consuming storage racks. Later, it was taken out of storage and installed at a new location.

Key element in centralizing this system is the use of steel wire mesh Cargotainers, specially designed by materials-handling engineers of Pittsburgh Steel Products Company for bulk handling of meters.

Meters are now collected at 12 distribution points and packed in Cargotainers that will hold up to 88 electric meters or up to 56 gas meters, depending on meter size. Loaded Cargotainers are picked up by one of two trailer trucks that can carry up to 24 Cargotainers each.

Delivered to the General Meter building, loaded Cargotainers are stored compactly by tiering them up to three high. From storage, they feed to highly automatic facilities equipped to service about 800 electric and 330 gas meters a day.

Serviced meters are loaded into Cargotainers again and trucked back to the distribution points. Here they are stored in a small area, and are installed to replace others requiring test and repair.

The Cargotainers used for this purpose by Consumers Power have 2,000 pound capacity. They measure 40 inches wide by 58 inches long, with heights of 24

inches and 32 inches and have been further modified for mobility and ease in handling with a minimum investment in lifting equipment.

Five inch diameter industrial casters are welded at one end to cross-bracing in the bottom of the Cargotainer. They clear the 7¾-inch legs of the Cargotainer by one inch.

To the bottom of the opposite end of the Cargotainer is welded a steel tongue of ½-inch steel, protruding 5 inches from the bottom of the container and having a hole in the end. With a mobile pry-bar, one man can engage the hole in the tongue, lift the Cargotainer and transform it into a cart with three-point suspension.

Mobilized Cargotainers are rolled onto a hydraulic lift tail gate for loading into the trailer truck. A simple hoist mechanism built into the rear of the truck engages fold-away crane eyes built into the sides of the Cargotainer, so the containers can be tiered two high in the truck. The 24-inch high Cargotainers are tiered on top of 32-inch high models, for maximum use of cargo space.

The entire loading and unloading operation can be accomplished by one or two men in a few minutes, either at the General Meter Building or at the distribution points.

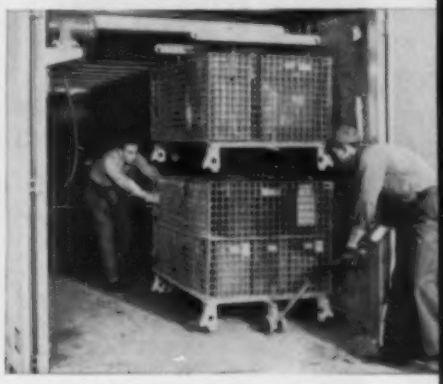
Speedier and more efficient meter service has resulted from this centralization, accompanied by substantial operating and distribution economics.

Individual records for all meters in service have been centralized and are now handled through a single IBM system with unerring accuracy. Duplicated record keeping, time-consuming compilation of test and repair cycles and voluminous reports have been eliminated.

Inventories of meters at each of the 16 test and repair stations have been reduced to smaller stocks at the 12 distribution points at an average saving in meter inventory of 35 per cent.

Manpower has been conserved through more efficient testing and repair methods at the General Meter building, making some trained employees available for other important assignments within the company. Concentration of the larger volume of meter repair work at one point has enabled Consumers Power to take full advantage of automation for more scientific accuracy and more rapid processing.

One man can conveniently position a loaded Cargotainer by using a pry-bar lift. Casters welded to bottom framework support the other end of Cargotainer.



Hydraulic tail gate lifts loaded Cargotainers to trailer truck bed level. A simple hoist mechanism enables tiering of Cargotainers for storage in transit.

Today, Cargotainers are saving handling costs in an ever-widening variety of industries, ranging from metalworking, textiles and meat packing to railroads and utilities. They can be "duty designed" to meet your specific requirements. Why not call our closest district office today or write for our informative brochure on "Duty Designed" Cargotainers?

"Everything New But The Name"

Pittsburgh Steel Products Company

a subsidiary of **Pittsburgh Steel Company**

Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES: Atlanta • Chicago • Cleveland • Columbus • Dallas Dayton • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh San Francisco • Tulsa • Warren, Ohio. **PLANTS:** Monessen, Pa. • Allenport, Pa. Akron • Los Angeles • Warren, Ohio • Worcester, Mass.

Pittsburgh Steel Products Co.
1410 Grant Building, Pittsburgh 30, Pa.

Gentlemen: Please send at once a copy of your free booklet "Duty Designed"—the Cargotainer story.

Name _____ Title _____

Company _____

Address _____

Every Movement has a SAVINGS of its own . . . . .

SAVE UP TO 75% of MATERIALS HANDLING COSTS WITH

HEAVY-DUTY FORK

LIFTRUK

OR

LIFT-O-KRANE

Leading Public Utilities find these heavy-duty, rugged SILENT HOIST machines dependable and efficient for the continuous, complex requirements of the transportation department, storage area, repair shop . . . in the movement of Generators and other heavy equipment, Cable, Wire, Maintenance Supplies, Poles and general equipment.

The LIFTRUK *Fork Lift Truck* and LIFT-O-KRANE *Combination Crane and Fork Lift Truck* handle capacity loads with maximum stability and safety. They have high lifting range. Make short turns in narrow spaces. Promote maximum efficiency for storage areas . . . and effect rapid inloading and outloading, with economic use of manpower.

Send for Bulletin 77 for LIFTRUK. Bulletin 75 for LIFT-O-KRANE

Makers of KRANE KAR Mobile Boom Crane, KARRI-GO Front Boom Crane, SILENT HOIST Cranes for Motor Truck Mounting, SILENT HOIST Winches and Capstans, SILENT HOIST Hydraulic Telescopic Truck Towers, etc.

SILENT HOIST & CRANE CO.

Pioneer Manufacturers of Heavy-Duty Equipment for Public Utilities and Municipalities

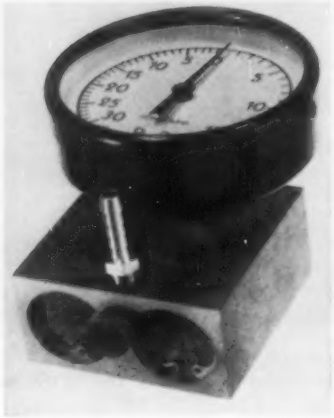
862 63RD STREET, BROOKLYN 20, N. Y.

Lighting Pole Base

These lighting pole bases are equipped with a three-wire, 20-amp, 250-v polarized weatherproof receptacle for plugging in small power tools or trouble lights.

Bases are made of malleable iron and are offered threaded for 2, 2½, 3 or 4-in. pipe sizes. They are available with a snap-open cover (illustrated) or a screw-on cover.

Hope Electrical Products Co, 335 Wilson Ave, Newark, N. J.



Breather Valve

The Circle Seal P-391 breather valve is designed to meet requirements of ASA C57.12a for control of temperature induced pressure changes in oil filled power transformers, according to the manufacturer. The unit, made of solid brass bar stock, can be mounted externally without additional protection. A standard gage connection is used and no additional piping is required.

Illustration shows valve with gauge attached.

James-Pond-Clark, 2181 E. Foothill Blvd, Pasadena 8, Calif.

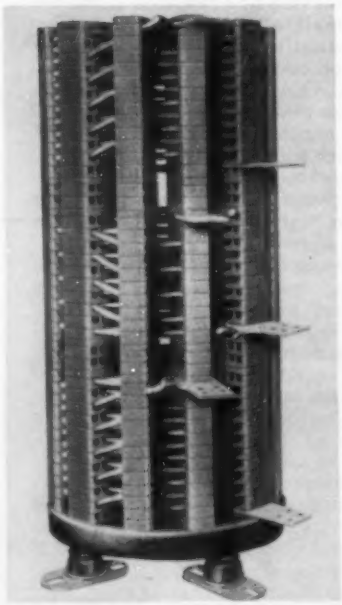
Current Limiting Reactors

These reactors for limiting short circuit currents to safe values and reducing effects of voltage distrurbances, are reported to be stronger, lighter and more durable.

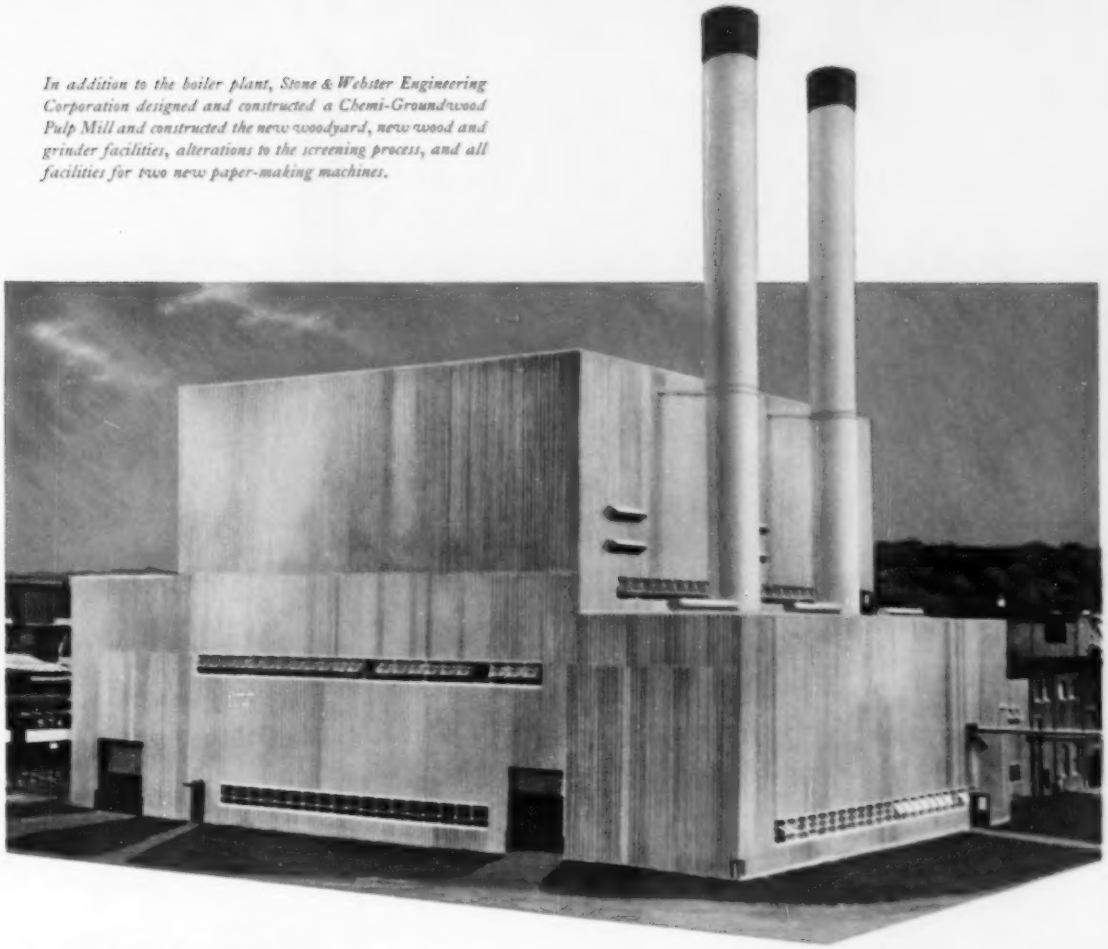
Reactor cable support columns are made of polyester-glass-resin cleats and epoxy-resin tie rods. This construction is said to provide the high compressive and tensile strength required to withstand thermal and mechanical forces imposed during short circuits. The wedge shape of the cleat increases the radiating surface on the inside turns and provides additional mechanical strength by shortening unsupported spans of cable on the outside turns. Mounting insulators screw into inserts in the concrete discs on which the columns are mounted.

The units are designed for indoor or outdoor service in single or three-

(*Continued on page* 215)



In addition to the boiler plant, Stone & Webster Engineering Corporation designed and constructed a Chemi-Groundwood Pulp Mill and constructed the new woodyard, new wood and grinder facilities, alterations to the screening process, and all facilities for two new paper-making machines.



POWER FOR NEWSPRINT PRODUCTION

As part of Great Northern Paper Company's extensive expansion of its newsprint plant at East Millinocket, Maine, Stone & Webster Engineering Corporation was retained to design and construct a new power station.

The station, which produces steam for power and processing, is of modern, compact design. There are two oil-fired boilers generating 300,000 pounds of steam per hour at 1250 psi, and a 12,500 kw turbine generator, with provision for a second unit of equal capacity.

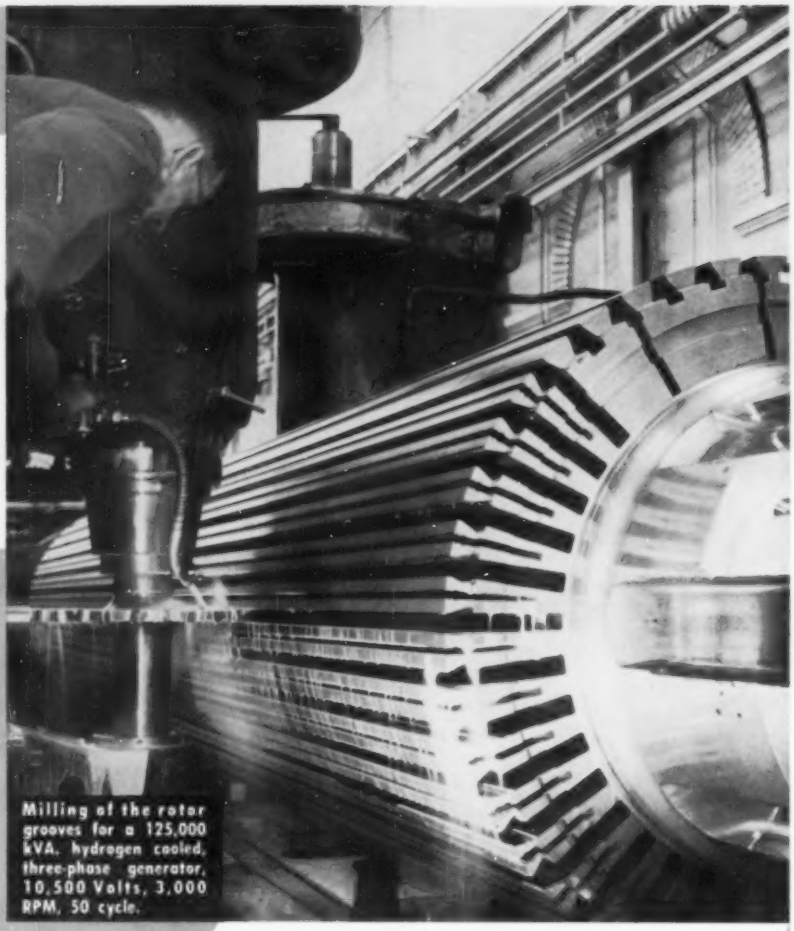
Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

skill that pays off



Milling of the rotor grooves for a 125,000 kVA, hydrogen cooled, three-phase generator, 10,500 Volts, 3,000 RPM, 50 cycle.

THE *quality* of Brown Boveri Turbo-Generators is consistently *high*, the *initial cost* consistently *low* . . . all because of *outstanding skill* . . . the *traditional skill* of Brown Boveri engineers and craftsmen that has taken years to acquire through long apprenticeships and is passed on from generation to generation.

Working with the best materials, taking the time that precision operations require . . . these men impart Brown Boveri's world-famous quality to each unit . . . plus the assurance of substantial savings for the purchaser.

You, too, can expect MORE . . . and get far MORE . . . from a Brown Boveri Turbo-Generator.

Write for the facts, today.

Only BROWN BOVERI Turbo-Generators have ALL these basic advantages:

1 – **Top Efficiency**
2 – **Thorough Dependability**
3 – **World-famous Quality**
4 – **Compact Design**
5 – **Long Life**
6 – **Minimum Maintenance**
7 – **Prompt Delivery**

All this – and LOWER INITIAL COST, too!

BROWN BOVERI

BROWN BOVERI CORPORATION

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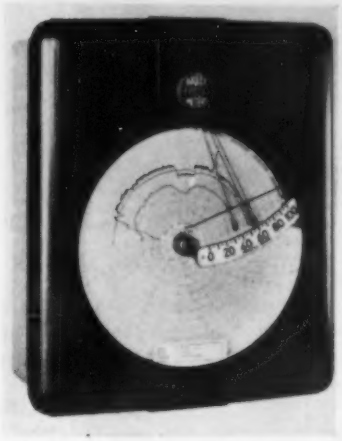
New Equipment

(*Continued from page* 212)

phase ratings from 5 to 6,000 kva, 300 to 6,000 amp and 1,201 to 34,500 v. They will withstand up to 33⅓ times normal full load current for five sec. **Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**



Receiver Recorder

This electronic receiver may house as many as four plug-in, dc receivers or two receivers and two pneumatic controllers. It is designed for use with telemetering systems in power and process plants, and laboratories.

Receiver ranges are 0-2 mv to 0-20 v dc. Error is less than ¼ % for spans of 10 mv or more, and ± 25 μv for lower spans. Pen speed is 5 sec from 0 to 100% scale span. Details are given in Product Specification E12-4. **Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio**

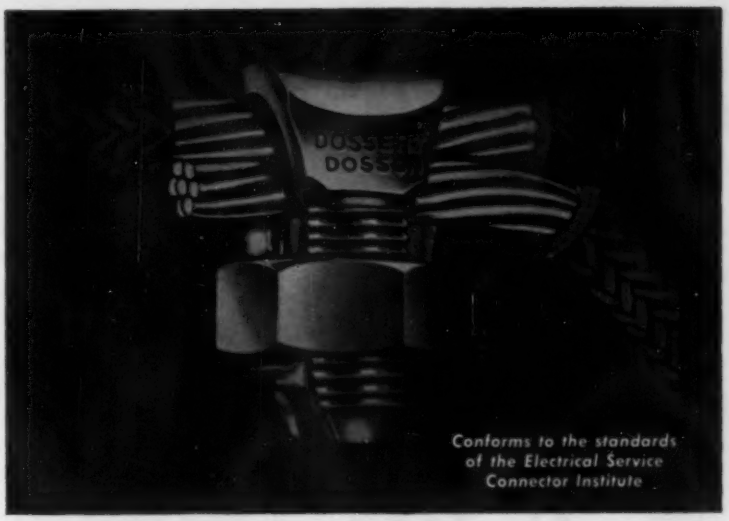
Aluminum Thimble

Aluminum thimbles that fit around rack or clevis pin insulators are being offered to strengthen small conductor loops. The thimbles provide a larger radius for the conductor loop, thus eliminating the weakening stresses set up in aluminum conductors when the loop is too small.

They have a wire groove radius of 1½ in. to accommodate No. 4 ACSR conductors.

Hubbard & Co, 6301 Butler St, Pittsburgh 1, Pa.

(*Continued on page* 216)



DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

Mail coupon for FREE Dosson "F" Connector

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:

Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

Name _____ Title _____

Company _____

Address _____ Zone _____ State _____

City _____

50 YEARS OF TECHNICAL LEADERSHIP

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

POWERS American

Sky-Master

HYDRAULIC AERIAL BEAM

CARRIES TWO MEN

UP·OVER
OUT·DOWN

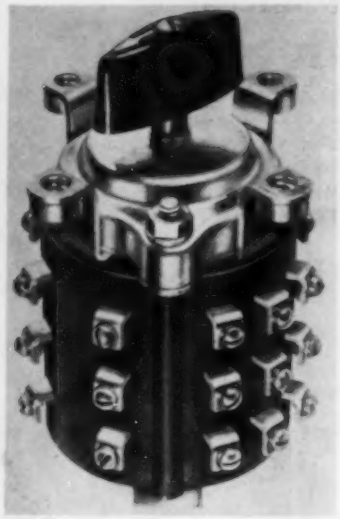
Climb into one of Sky-Master's insulated work baskets. Move one lever . . . to raise the inner beam to any point in an 85° arc. Move another lever . . . to position the outer beam anywhere in a 265° arc. Move the third lever . . . to turn the revolving mast in the direction you choose. That's how easy it is to operate Sky-Master . . . the hydraulic aerial beam that carries two men up, out, over, or down.

In a size for reaching 42′ or 48′ above ground—on a Powers-American Body that fits *your* work needs.

Descriptive literature and price information is yours for the asking —without obligation.

McCABE-POWERS AUTO BODY COMPANY

5000 NORTH BROADWAY • ST. LOUIS 15, MO. 825 CEDAR ST. • BERKELEY 10, CALIF.



Rotary Switch

A choice of detent action or snap action in a multipole, rotary selector switch is afforded in the JD-JS line. Switches are designed for tap, transfer or selector applications. They are rated 30 amp, 230 v ac, and can be furnished with up to five poles. Write for Bulletin No. 5 for details.

Electro Switch Corp, Weymouth 88, Mass.

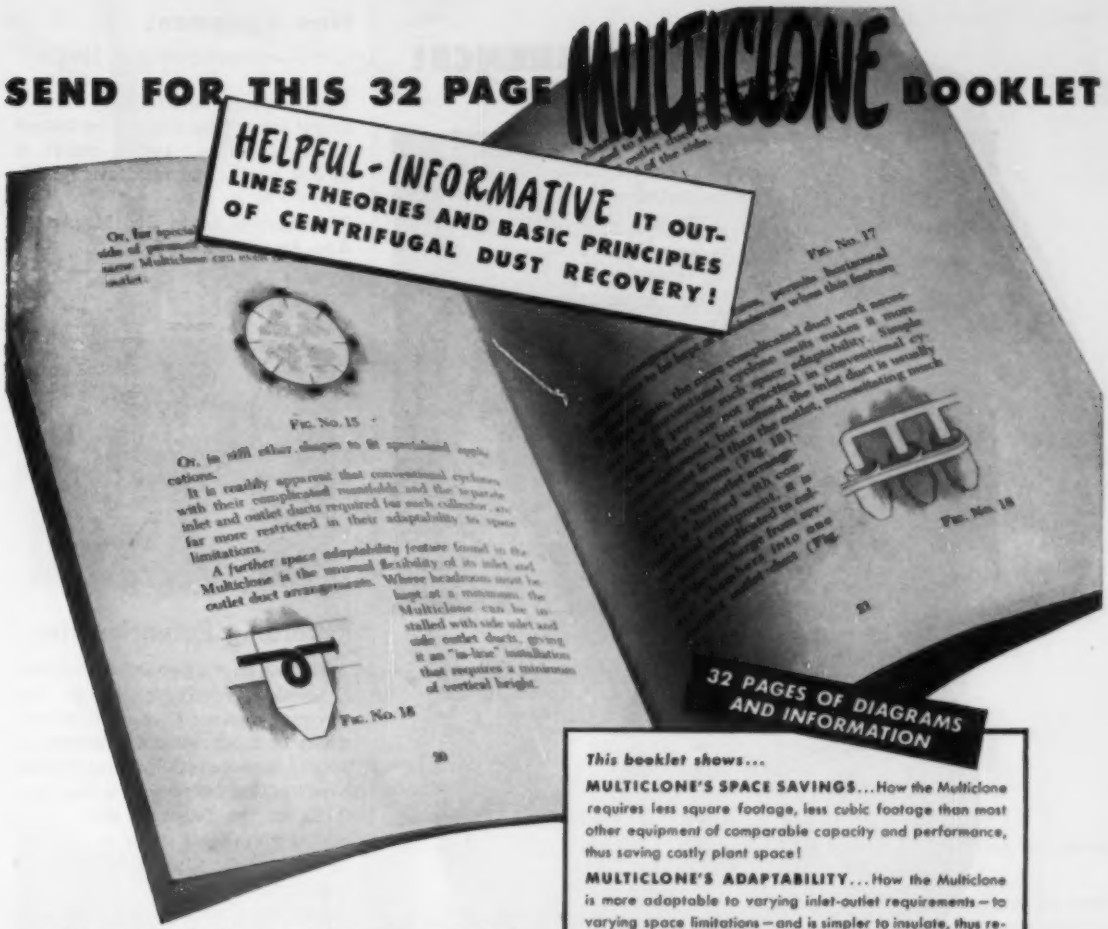
Industrial Lamp

The Type P-H1 is a 400-w fluorescent-mercury lamp of the semi-reflector type. It is described as a high efficiency light source of acceptable color quality for use in industrial installations, especially where dirt accumulation is appreciable.

These lamps can be installed in most fixtures for 400-w A-H1, E-H1 or

(*Continued on page* 218)

SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 15
Fig. No. 16
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

NOW SELLING...

COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of the U. S. A. and foreign countries.

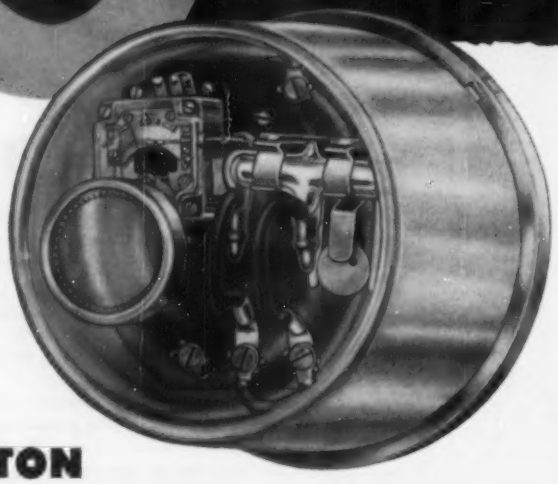
WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
3252 PEACHTREE RD. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

6 POINTS OF DIFFERENCE!

- NO VACUUM TUBES USED—no resistors or capacitors
- NO STAND-BY POWER REQUIRED—uses only about 4 watts for 1 minute operating cycle daily
- LONGER LIFE—only a few time-tested standard parts employed
- ADJUSTMENTS UNAFFECTED—pre-set operating points unaffected by changes in ambient temperatures, voltage, humidity or power failures. No warm-up required.
- LOW MAINTENANCE
- SIMPLE INSTALLATION AND REPLACEMENT



WESTON

plug-in ILLUMINATION CONTROL

With only a few time-tested and proved parts enclosed in a standard weatherproof watt-hour meter glass case, this unit will give years of uninterrupted, maintenance-free service. Automatically turns lights on and off at pre-set levels. The most efficient, economical unit for controlling STREET LIGHTING—OBSTRUCTION MARKERS—ADVERTISING SIGNS—INDUSTRIAL LIGHTING etc. Ask for bulletin B30D. Weston Electrical Instrument Corporation, 614 Frelinghuysen Ave., Newark 5, N. J.—a Subsidiary of Daystrom, Incorporated.

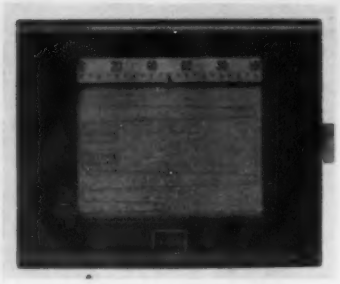
WESTON *Instruments*

New Equipment

(*Continued from page* 216)

J-H1 mercury lamps. They have a mogul screw base and can be burned in any position. Initial output is 19,000 lumens and rated average life is 6,000 hr.

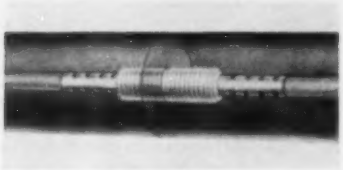
Westinghouse Lamp Div, MacArthur Ave, Bloomfield, N. J.



Recording Potentiometer

The pen of this high speed electronic Dynamaster recorder makes the traverse across the 11-in. chart in four-tenths of a sec without overshoot at the end, says the manufacturer. "Dead-band" of the instrument is less than 0.1% of the full-scale span. It is offered with ranges as low as 1 mv for full-scale, with source resistance up to 10,000 ohm.

Bristol Co, Waterbury 20, Conn.



Graphite Anode

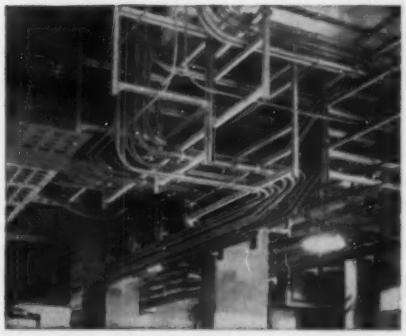
Type QA graphite anodes have been developed for installation in cable ducts to provide protection for metallic sheathed cables in adjacent ducts at relatively low current consumption.

Anodes are attached by means of crimp type connectors on sizes 4, 6 or 8 seven strand cable, at any desired spacing. They are offered in three sizes: 2 x 12 in., 2 x 20 in. and 3 x 30 in. Details are given in Bulletin S-6525.

National Carbon Co, 30 E. 42nd St, New York 17, N. Y.

(*More New Products on page* 220)

Somebody picking your pockets?



Installing close runs is easier, especially in awkward places, with Republic ELECTRUNITE E. M. T. Since every coupling is a union, joints are easily made without turning the whole run. Intricate runs are easily duplicated.

At least, your electrical conduit installations may be costing you more extra dollars than necessary.

HERE IS THE MODERN, STEEL ELECTRICAL RACEWAY THAT LASTS AND LASTS. In some utilities, it's been on the job more than 15 years, and still going strong.

HERE IS THE RACEWAY THAT GIVES YOU PROTECTION. The protection of steel *plus* unbroken galvanized coating from end to end. No threads to cut. No lines to turn. You get cost savings as well as the protective features.

HERE IS THE RACEWAY THAT SAVES ON INSTALLATION COSTS. Because it's lighter, there's less weight to handle. "Inch-Marks"* on the popular sizes help make accurate bends to fit in close quarters, even where there are multiple bends. Installation is easy, even though equipment has already been installed.

Check the costs and advantages. Protect your pocketbook. Specify Republic "Inch-Marked" Electrical Metallic Tubing for your new building program. For modernizing, too. It's produced to A.S.A. Specification C80.3, Federal Specification WW-T-806 and is Underwriters' Laboratories inspected. Write for all the facts.

REPUBLIC STEEL

STEEL AND TUBES DIVISION • 213 EAST 131st STREET • CLEVELAND, OHIO

World's Widest Range of Standard Steels and Steel Products

Made by the producers of ELECTRUNITE...The Original Electric Welded Boiler Tube

NEW BUCKEYE
MODEL 403
for Service Lines Conduit and Cable Small Mains

Here's the *first* and *only* low-cost production ditcher designed especially for service line work! . . . Digs flush with foundations and obstructions; eliminates hand finishing . . . Exceptionally maneuverable and highly mobile — *plus* fast ditching ability . . . Digs ditch 8", 10" or 12" wide to 5' depth; 14" or 16" wide to 4' depth.

WORKS UNDER ADVERSE CONDITIONS . . .
Full crawler mounted for high flotation and maximum traction with low ground-bearing pressure.

EASILY TRANSPORTED . . .
Small size and low silhouette permit fast job-to-job travel on small tilt-bed or flat bed trailer.

No. 5522

GAR WOOD INDUSTRIES, INC.
WAYNE, MICHIGAN

MORE NEW PRODUCTS

Schenectady Varnish Co, 200 Congress St, Schenectady 1, N. Y., has developed a heat-reactive **insulating varnish** to impregnate electrical coils for stationary and moving parts on Class B equipment. The varnish, No. 99B, is reported suitable for application over synthetic enameled magnet wires such as Isonel, Silicone, Formvar, or Nylon.

Harnischfeger Corp, Milwaukee 46, Wisc., offers a line of 500, 750 and 1,200-amp **constant-voltage welders** which allow the operator to select any desired arc voltage.

Minnesota Mining & Mfg Co, Dept. E5-245, 900 Fauquier St, St. Paul 6, Minn., has a **polyester fabric** in nonwoven, felted form for wrapping coils, transformers, motors and other electrical components.

Champion Rivet Co, Harvard Ave & E. 108th St, Cleveland 5, Ohio, has a line of low alloy steel **arc welding electrodes** for welding Chromium Molybdenum alloy steels.

Hoffman Engineering Co, 1204 Tyler St, Anoka, Minn., has oil-tight **push button enclosures** made from 14 gauge steel in ten standard sizes for 1, 2, 3, 4, 6, 9, 12, 16 and 25 control units.

Steber Mfg Co, Broadview, Ill., has all aluminum horizontal fluorescent "T" **lighting fixtures** in 4 and 8 ft lengths. Details in Bulletin No. 140-55.

National Vulcanized Fibre Co, 1055 Beech St, Wilmington 99, Del., has an electrical grade phenolic **laminated plastic** which can be punched at room temperature.

Taylor Electric, Inc, 15400 Dale, Detroit 23, Mich., is making rigid Geon vinyl plastic **wiring duct** for use in control panels. Duct is said to hold, protect and distribute wiring while eliminating lacing.

R. B. Denison Mfg Co, 102 St. Claire Ave N. W., Cleveland 13, Ohio, has a line of heavy-duty, water-tight **machine tool switches** (NEMA types 1-A, 2, 4 and 5). Switches are available in a variety of styles.

Smithcraft Lighting Div, Chelsea 50, Mass., offers a line of 2-ft wide **troffers** that have no catches, latches, hinges, screws or bolts visible to the eye.

Hanson-Van Winkle-Munning Co, Matawan, N. J., offers a carbon pile **tank rheostat** for electroplating applications requiring precise current control. It provides all tank voltages up to 12 v for a specified line voltage, and currents from 30 to 250 amp.

Arrow Fastener Co, Inc, 1 Junius St, Brooklyn 12, N. Y., offers the T-25 **staple gun** for fastening low-voltage wire.

Minneapolis-Honeywell Regulator Co, Micro Switch Div, Freeport, Ill., has designed a single-actuated **dual switch** for controlling two isolated circuits at the same time. Basic 6AS13 switches are rated 15 amp at 125, 250 or 460 v ac, ½ amp at 125 v dc and ¼ amp at 250 v dc.

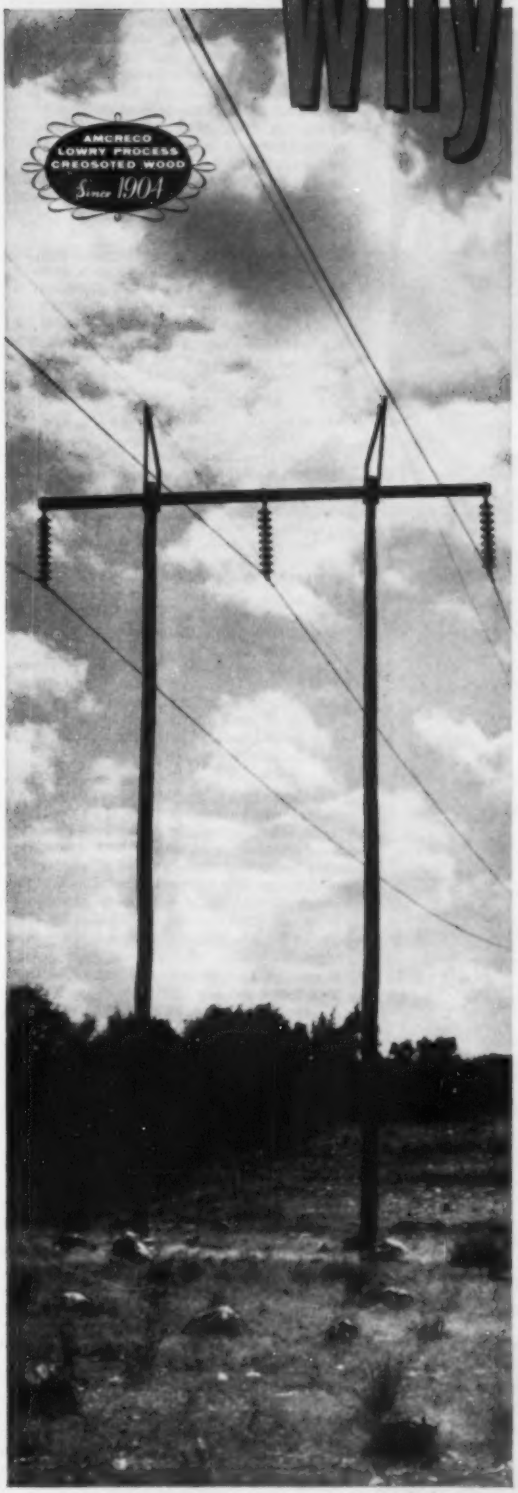
Kato Engineering Co, Mankato, Minn., has a series of ac **generators** ranging up to 500 kva in standard voltages up to 2.3 kv.

Ebert Electronics Corp, 212-26 Jamaica Ave, Queens Village 28, N. Y., offers Micrelay, a low current, low power actuated **relay** for control of loads up to 60 amp.

Amercoat Corp, 4809 Firestone Blvd, South Gate, Calif., has Dimetcote, an inorganic, metallic **zinc coating** for protection of steel structures. It can be applied by spray or brush.

Stearns Magnetic Inc, Milwaukee 46, Wisc., offers the H Style 1000 Series **magnetic brake** for use in the 25 to 50 hp range with both old and re-rated NEMA frame sizes. It is said to develop higher torque and take up less space. Ratings are 125 lb ft and 175 lb ft.

R. W. Cramer Co, Inc, Centerbrook, Conn., has a synchronous motor driven **time delay relay** featuring ¼ of 1% repeat accuracy. It is available in 14 ranges from 6 sec through 24 hr, for 115 and 200 v; 25, 50 or 60 cps.



Why do you invest money in treated woods?

The basic reason why you invest money in treated poles, cross arms, conduit and other construction woods is because they last longer. You know that every dollar spent on properly treated wood products will save you many, many dollars later on in pole renewals, cross arm replacement and other repair and maintenance work.

The first question that you must ask yourself when investing in treated woods is, "Just how much will this particular preservative or process increase the service life of our wood?"

With Amcreco Creosoted Products, that question has been answered. Wood, pressure treated with creosote by Amcreco, lasts for years and years with great strength throughout the life of the wood, and with high resistance to fungi, borers, insects and all natural enemies of wood.

Write our nearest office for estimates or quotations on treated poles, cross arms, conduit, timbers and other construction woods. We would appreciate an opportunity to quote on your needs.

AMERICAN CREOSOTING COMPANY

Shreveport Creosoting Company
Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

Georgia Forest Products Company
Gulf States Creosoting Company
Georgia Creosoting Company
Kettle River Company

LOUISVILLE 2, KENTUCKY
18 FIELD SALES OFFICES TO SERVE YOU

SAVE
WITH
Reliable
STRANDLINK

THE ECONOMICAL
SELF-CONTAINED
SELF-ACTING
TOOL FOR SPLICING STRAND

STRANDLINK is known to be the most economical means for splicing strand wherever strand is used because, among other things, Strandlink eliminates nuts, bolts, hardware, johnny balls and special tools and sleeves. Strandlink splices same size or reduces from one size to another.

STRANDLINK makes splicing of any grade or size strand, simple and easy, and safe and sure. The exclusive Reliable PILOT CUP caps and guides the strand to its proper position. The gripping jaws with hundreds of case-hardened, plated steel teeth HOLD the strand permanently. The entire assembly is factory treated with corrosion inhibitor lubricant. Many well-known users have made Strandlink their standard. It is approved by government agencies.

WRITE for a sample STRANDLINK and see for yourself its money saving-features. Specify size (⅜", ¼", ⅝", ½", ¾") when requesting sample.

Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Illinois

Over 45 years of service to the Utilities

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

CATALOGS—BULLETINS

● **TEST INSTRUMENTS:** Data sheet 4755 describes a line of portable test instruments for checking, calibrating and coordinating reclosers, sectionalizers, induction disc relays and other protective devices. It covers component equipment for making preliminary and in-line performance checks on minimum trip current, operating sequence, lockout, counter operations and co-ordination with other reclosers and sectionalizers. Included is a recommended procedure for periodic recloser maintenance care. Multi-Amp Corp, 10 Third St, Newark, N. J.

● **ALUMINUM WIRE:** The economy, installation and performance of aluminum Type TW building wire are discussed in a 7-page bulletin. Charts and tables list the characteristics of various size wires. Kaiser Aluminum & Chemical Corp, 1924 Broadway, Oakland 12, Calif.

● **A-C BULLETINS:** The following are available from Allis-Chalmers Mfg Co Milwaukee 1, Wisc.:

Vault-type transformers are covered in Bulletin 61B8208. The bulletin describes construction and gives approximate dimensions of transformers in ratings from 112½ to 500 kva.

Step regulators and how their ratings can be increased are discussed in Bulletin 21R8317. It shows how the losses of step regulators decrease as the tap changer moves closer to the neutral position and how it is possible to increase current ratings when operating on these taps.

A silicone-rubber insulating system, called "Silco-Flex", for motor and generator stator windings is described and illustrated in Bulletin 05R8341. Thermal and mechanical, electrical, and chemical properties are covered.

● **COMPRESSION CONNECTORS:** An illustrated 18-page bulletin (13A) describes Squeezon compression connectors for overhead distribution connections from line wire to ground rod. It also describes the mechanical and hydraulic installation tools required and tells where to use each. James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

● **FEDERAL PACIFIC BULLETINS:** The following are available from Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.:

Metal-clad bus duct is described and illustrated in Catalog No. 3-105 (95 pages). Covered are plug-in, low-impedance and weatherproof feeder types. Ratings and dimensions of each type are given along with detailed engineering information for bus applications to feed various types of equipment. A typical specification is included.

Metal-enclosed switchgear with low-voltage drawout type DMB air circuit breakers are covered in Catalog No. 3-405. Catalog contains complete descriptions of switchgear construction and operation, circuit breakers, feeder bus arrangements and typical power connections. Sections are devoted to application information for circuit breakers and typical specifications for complete switchgear assemblies.

Metal-clad switchgear with Type DST magnetic air circuit breakers are described and illustrated in Catalog No. 3-550. Included are indoor and outdoor equipments in the 5 to 15-kv class, 600 to 1,200 amp. Ordering information is given along with ratings and dimensions.

● **NUCLEAR REACTOR SIMULATOR:** Details of a nuclear reactor simulator which electronically duplicates operating characteristics of actual reactors are covered in Folder ND46-70-700(2). Illustrations are included along with a discussion of the theory of the simulator's operation. Leeds & Northrup Co, 444 N. 16th St, Philadelphia 30, Pa.

● **ADJUSTABLE SPEED DRIVE:** Bulletin No. 4400-PRD-229, 4 pages, illustrates and describes construction and operation of an adjustable speed magnetic drive for motors. Selection chart, ratings and dimensions are included. Electric Machinery Mfg. Co, Minneapolis 13, Minn.

● **HEATERS:** A complete line of electric cartridge heater units is described and illustrated in Bulletin 850, 4 pages. Construction features, dimensions and ratings are given. Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa.

● **DISTRIBUTION EQUIPMENT:** Distribution equipments designed for 100-amp service are covered in an 11-page Booklet (Form No. 1100A). Descriptions and ratings are given for safety switches, service entrance, fuse panels, meter mountings, magnetic-hydraulic circuit breakers and load centers. Included is information on appliance loads and home wiring. Murray Mfg Corp, 1250 Atlantic Ave, Brooklyn 16, N. Y.

● **INSULATION:** Flexible electrical insulation materials are covered in this general catalog. Insulation is divided into coated products, varnished and plastic products, for which various properties are given. Useful charts and conversion tables are included. Write on company letterhead to: Sales Promotion Dept, Irvington Varnish & Insulator Div, Minnesota Mining & Mfg Co, Irvington, N. J.

● **TRANSMISSION TOWERS:** Bulletin No. 2509 covers adjustable transmission towers. Body and leg extensions to both double and single circuit towers are described. Structural and Tower Dept, Blaw-Knox Co, Pittsburgh, Pa.

● **FIRE PROTECTION:** A 36-page booklet gives detailed information on all types of Foamite Airfoam equipment for combatting various flammable liquid fires. American La France Corp, Elmira, N. Y.

● **OXYGEN ANALYZER:** Bulletin 110-A describes the application of Model 2B2B dissolved oxygen analyzer for steam generating plants. Arnold O. Beckman, Inc, 1020 Mission St, South Pasadena, Calif.

● **NULL INDICATOR:** A 2-page bulletin describes the Magnetik Null Indicator, a portable temperature measuring instrument. Complete engineering data is included. Doelcan Div, Minneapolis-Honeywell Regulator Co, 1400 Soldiers Field Rd, Boston 35, Mass.

● **VIBRATION SWITCH:** Bulletin 500-4, 1 page, discusses construction, operation and applications of a system for detecting and controlling vibration in rotating machinery. Ratings and installation information are included. Beta Corp, Box 8625, Richmond 26, Va.

● **FLUORESCENT FIXTURES:** Open-type fluorescent fixtures in 4 and 8-ft lengths for two or four lamps are described and illustrated in Form OD-636, Day-Brite Lighting, Inc, 5411 Bulwer Ave, St. Louis, Mo.

SAVE WITH Reliable® STRANDVISE

THE ECONOMICAL SELF-CONTAINED SELF-ACTING TOOL FOR TERMINATING STRAND

STRANDVISE terminates guy strand, suspension strand and static wire. Strand feeds through to any tension without wasteful loops or hardware and accessories whose installed cost is high. Strandvise conserves manpower, saves time and money and is safe and sure.

STRANDVISE holds permanently, yet makes it easy to get the desired tension or make later adjustment to take up slack. Strandvise is reusable.

A choice of rigid or flexible bails available with STRANDVISE provides for the several types of pole hardware. There is also a long flexible bail that simplifies "false deadending" in slack span construction.

Wherever strand is used for any purpose, STRANDVISE provides the simplest, most economical and most satisfactory means for termination.

WRITE for sample STRANDVISE and see for yourself its many advantages. Specify size (⅛", ¼", ⅜", ½", ⅝") when requesting sample.

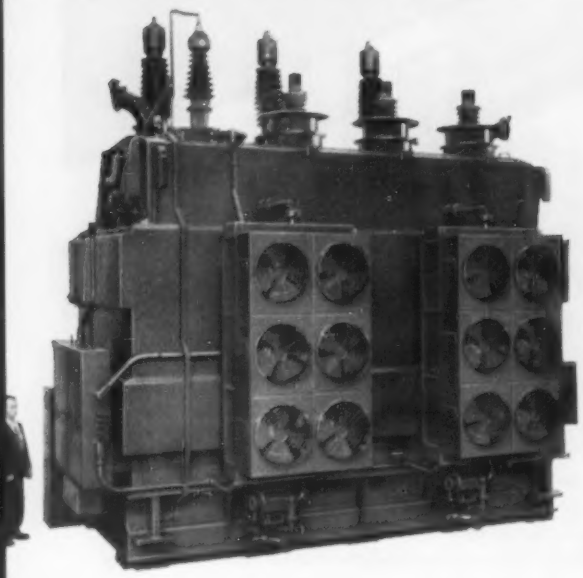
Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Illinois

Over 45 years of service to the Utilities

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

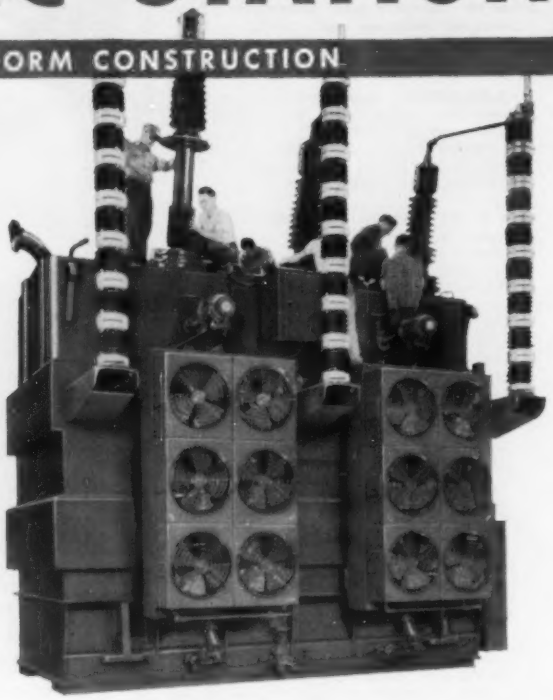
MAIN STEP-UP
GENERATING STATION

CONTOUR-DESIGN, SHELL-FORM CONSTRUCTION



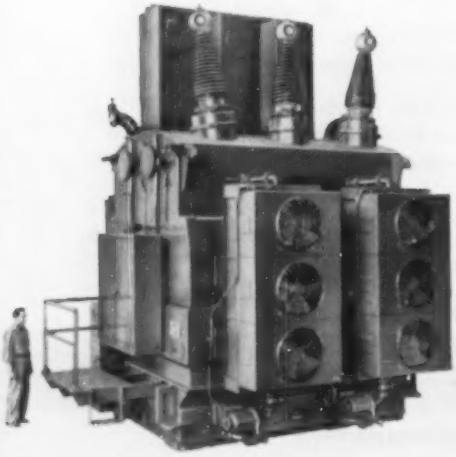
175,000 Kva 3 PHASE

High Voltage: 115,500 Grd. Y volts
Low Voltage: 17,500 Delta volts
Oil-immersed, forced-oil-cooled with forced-air cooler



140,000 Kva 3 PHASE

High Voltage: 115,000 Grd. Y volts
Low Voltage: 14,700 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air-cooler



120,000 Kva 3 PHASE

High Voltage: 145,000 Grd. Y volts
Low Voltage: 19,800 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air cooler

CORE-FORM CONSTRUCTION

56,000/70,000 Kva SINGLE PHASE

High Voltage: 93,000/161,000 Grd. Y volts
Low Voltage: 19,000 volts
Oil-immersed, self-cooled/forced-air-cooled

TRANSFORMERS

BY

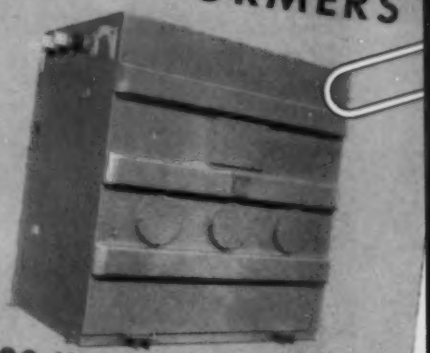
PENNSYLVANIA

. . . pioneer of 1-piece shipment of large power transformers

The three main step-up transformers pictured at the left are "giants" from the standpoint of kva capacity — ranging from 120,000 kva to 175,000 kva. In physical size, however, their dimensions and weights were kept well within the limits for *one-piece shipment.* This was possible because of the extreme compactness of Pennsylvania's own "contour design" shell-form construction.

The units traveled to their respective installation sites in an upright position, with only bushings, cooling equipment and certain accessories removed. This meant easier handling in the field, with greatly reduced installation time and costs.

Station Auxiliary TRANSFORMERS



2,000 Kva SILICONE-INSULATED DRY-TYPE TRANSFORMER

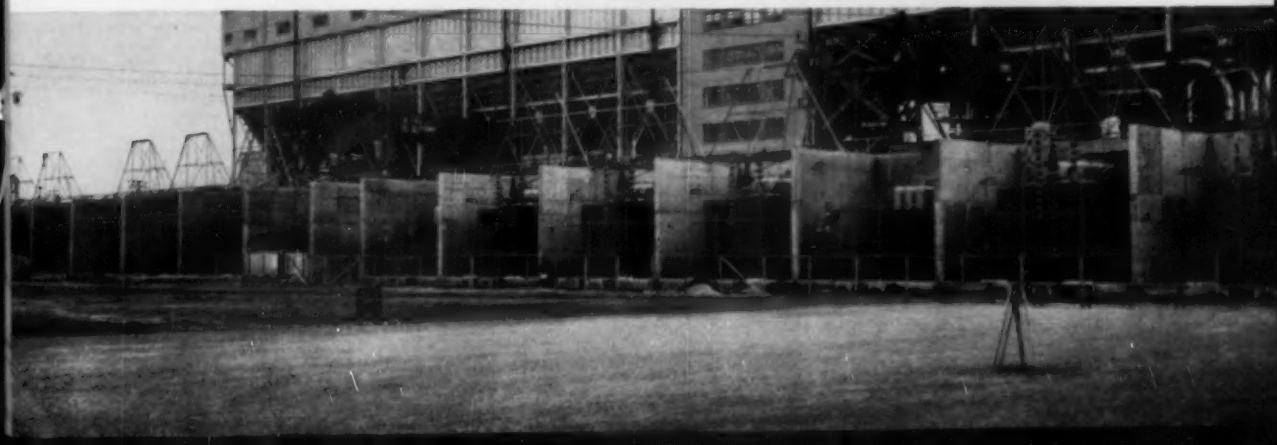
Just as Pennsylvania led the way in one-piece shipment of large power transformers, the company also pioneered the development of silicone-insulated units —the fire- and explosion-resistant transformers that are safest of all for both indoor and outdoor installations.

The 2000 kva station auxiliary unit pictured is believed to be the largest silicone-insulated (formerly "Class H") transformer ever built. It is a group 3, sealed-in nitrogen, dry-type unit; three phase, 60 cycles, 150°C. temperature rise; 2400Δ—480Δ volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

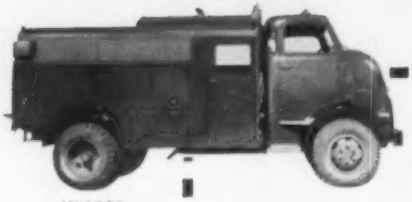
As the *pioneer* of one-piece shipment of large power transformers, Pennsylvania has long been offering this time-saving, cost-cutting advantage with *core-form* transformers as well as with contour-design (shell-form) units. For example, the nineteen 56,000/70,000 kva main step-up generating station transformers pictured here were shipped to their destination in an upright position, completely assembled except for bushings and detachable radiators.



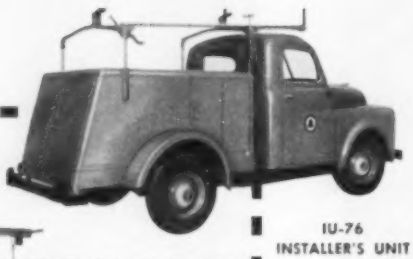
HIGHWAY

LINE CONSTRUCTION AND MAINTENANCE EQUIPMENT

HC EARTH BORING MACHINE



MW-128 UTILITY TRUCK BODY



IU-76 INSTALLER'S UNIT

PWD-2 CABLE REEL TRAILER

Highway line construction and maintenance equipment — designed for safety, dependability, economy and long, trouble-free service life — the most completely engineered equipment available today.

That's the reason Highway equipment is more widely specified and used than *any other*. Highway's complete, experienced engineering service and extensive production facilities mean the right solution to *your* problems too! Call, wire or write for full information and specifications today.

HIGHWAY TRAILERS

HIGHWAY TRAILER COMPANY

HEADQUARTERS: EDGERTON, WISCONSIN

MANUFACTURERS OF:

Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers • Public Utility Bodies • Earth Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-Offs • Service Accessories

SALES AND SERVICE IN PRINCIPAL CITIES

TECHNICAL LITERATURE

TRANSMISSION LINES—"Lighting Performance of Typical Transmission Lines" (second edition) is a 130-page report of lightning experiences of 68 power companies in the operation of 119 different lines. It also includes reports of foreign transmission lines. Each line covered is illustrated with a photograph and line drawing with principle dimensions of the typical structure. Complete information about each line's design, construction, operation and performance is given. This data is also listed in table form in an appendix for comparison of line performances. Persons requesting copies are asked to explain their interest in the book to help in the future preparation of similar material. Ohio Brass Co, Mansfield, Ohio.

COOLING TOWER STANDARDS—The following are available from the Cooling Tower Institute, 444 Emerson St, Palo Alto, Calif.,:

Bulletin TSC-302 — "Cooling Tower Wood Maintenance"—This bulletin classifies and discusses types of deterioration and presents maintenance procedure for control of deterioration. Price 50¢.

Bulletin ATP-105—"Acceptance Test Procedures for Water-Cooling Towers"—Contains recommended procedures, including instrumentation, for determining water-cooling capability of mechanical draft cooling towers. Price 50¢.

Bulletin STD-101—"CTI (Cooling Tower Institute) Grades of Redwood Lumber"—Presents recommended specifications for selection of grades of redwood lumber for structural design of industrial cooling towers. Price 25¢.

Bulletin STD-102—"Structural Design Data"—This bulletin is designed for use with STD-101. It gives allowable design stresses for structural design of redwood cooling towers. Price 25¢.

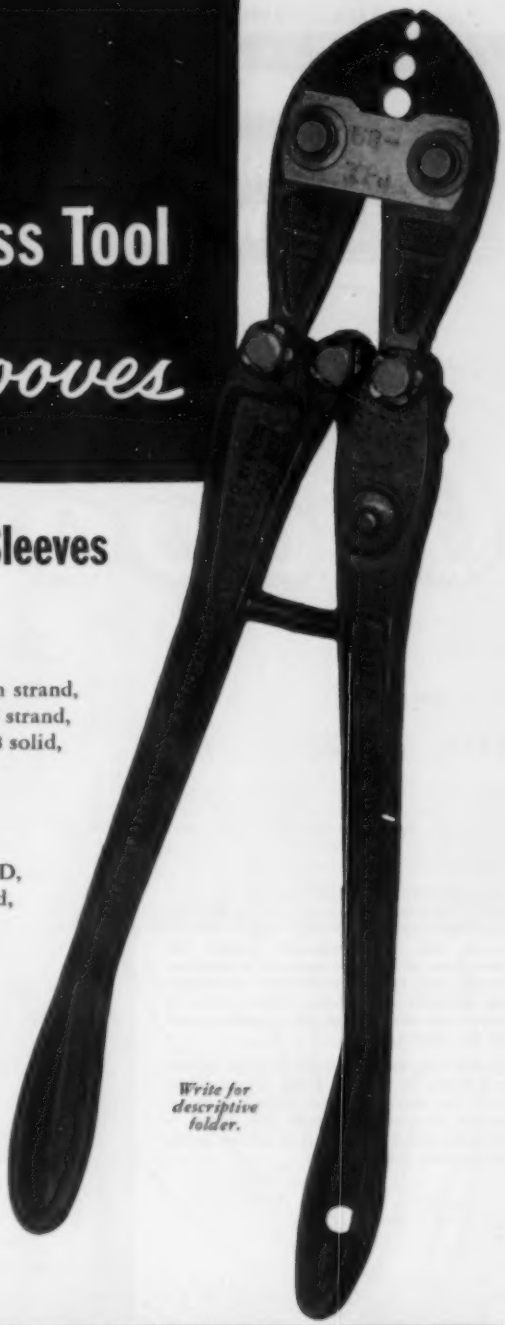
INSULATORS—Porcelain insulators for overhead lines is the subject of the International Electrotechnical Commission's Document No. 75. It contains recommended tests for verifying dimensions of insulators, for performance, and tests for quality to determine defects that may have occurred in manufacturing. Price $2.40—40 pages. American Standards Assn, 70 E. 45th St, New York 17, N. Y.

INSULATING OILS—Details on the installation and operation of a system for preventing deterioration of power system oils and hydraulic oils are presented in a 118-page book entitled—"Activated Alumina Maintenance Program—Power System Oils." The book deals with the economics, and the installation and operation of a preventive maintenance program for oils used in transformers, circuit breakers, oil-filled bushings, storage tanks, oil lines and other equipment. Also included are discussions of the methods of keeping maintenance and cost records, the performance characteristics of power system oils and oil testing procedures for operation of the program. Aluminum Co of America, 764 Alcoa Bldg, Pittsburgh 19, Pa.

PYROMETERS—Service tips for pyrometer users are given in bulletin F 7259. Among the subjects covered are: "What to do if instrument is reading erratic", "Instrument temperature curve off", "Instrument reading too high", "Instrument reading too low", and Instrument controls erratically." Barber-Coleman Co. Wheelco Instruments Div., Rockford, Ill.

NEW

No. 53-XPJ Nicopress Tool with *Three Grooves*



Accommodates Nicopress Sleeves

FOR COPPER

1 solid, 1 seven strand, 2 solid, 2 seven strand, 2 three strand, 3 solid, 4 solid, 4 seven strand, 4 three strand, 6 solid, 6 seven strand, 8 solid, 8 seven strand, 3 No. 10, 3 No. 8.

FOR COPPERWELD

4A, 6A, 8A, 6C, 8C, 6D, 8D, 9½D, 3 No. 10, 3 No. 12, 4 solid, 6 solid, 8 solid, 10 solid.

FOR ALL-ALUMINUM

2 solid, 2 seven strand, 4 solid, 4 seven strand, 6 solid, 6 seven strand, 8 solid.

FOR AMERDUCTOR

8SCP or SCG, 10SCP or SCG, 12SCP or SCG.

Write for descriptive folder.

Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and foreign countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

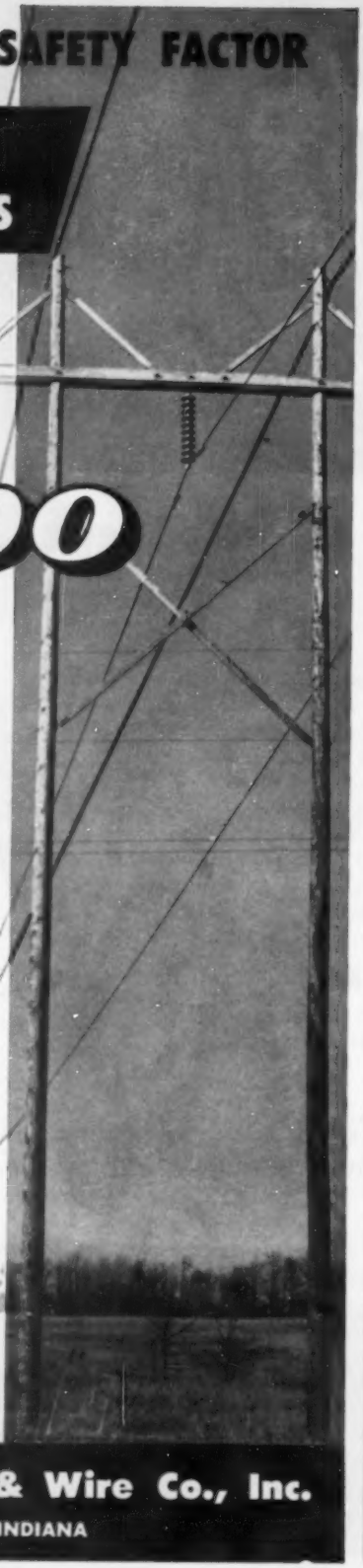
Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

For that EXTRA SAFETY FACTOR

in OVERHEAD GROUND WIRES



Crapo

Weldless Galvanized STEEL STRAND

MAXIMUM STRENGTH and dependability in overhead ground or static wire is assured when you specify *Crapo* Weldless Galvanized Steel Strand, specially designed and manufactured to shield transmission lines against lightning.

CONTINUOUS LENGTHS of this 7-wire strand are produced without welds or joints of any kind in either the individual wires or finished strand. High fatigue endurance provides that extra factor of safety so important in overhead ground wire. Laboratory-controlled manufacturing constantly insures high, uniform quality to make it your most practical and economical strand for this purpose.

Crapo GALVANIZING applies a dense, uniform and ductile zinc coating, tightly bonded to the wires for lasting protection against corrosion. *Crapo* Weldless Galvanized Steel Strand is available with Class A, B or C coatings in approved sizes and grades.

Ask your *Crapo* representative for Booklet OG-25 containing Sags and Tension data . . . or write direct!

INDIANA Steel & Wire Co., Inc.

MUNCIE, INDIANA

BOOKS

Books Received Since September 19, 1955

Chemical Engineering Series. By Richard Stephenson. Published by McGraw-Hill Book Co, New York 36, N. Y. 387 pages, illustrated. Price $8.00.

Industrial Furnaces, Vol. II—3rd Edition. By W. Trinks. Published by John Wiley & Sons, Inc. 440 Fourth Ave, New York 16, N. Y. 358 pages, illustrated. Price $10.00.

Transmission-Line Theory. By Ronold W. P. King. Published by McGraw-Hill Book Co, New York 36, N. Y. 509 pages, illustrated. Price $12.00.

Electronic and Radio Engineering. By Frederick E. Terman. Published by McGraw-Hill Book Co, New York 36, N. Y. 1078 pages, illustrated. Price $12.50.

Radio Operating Questions and Answers. By J. L. Hornung and A. A. McKenzie. Published by McGraw-Hill Book Co, New York 36, N. Y. 571 pages, illustrated. Price $4.50.

Introduction to Electric Analogue Computers. By C. A. A. Wass. Published by McGraw-Hill Book Co, New York 36, N. Y. 237 pages, illustrated. Price $6.50.

From Theory to Practice

Electro-Technology. By M. G. Say. Published by Philosophical Library Inc, 15 East 40th St, New York 16, N. Y. 167 pages, illustrated. Price $6.00.

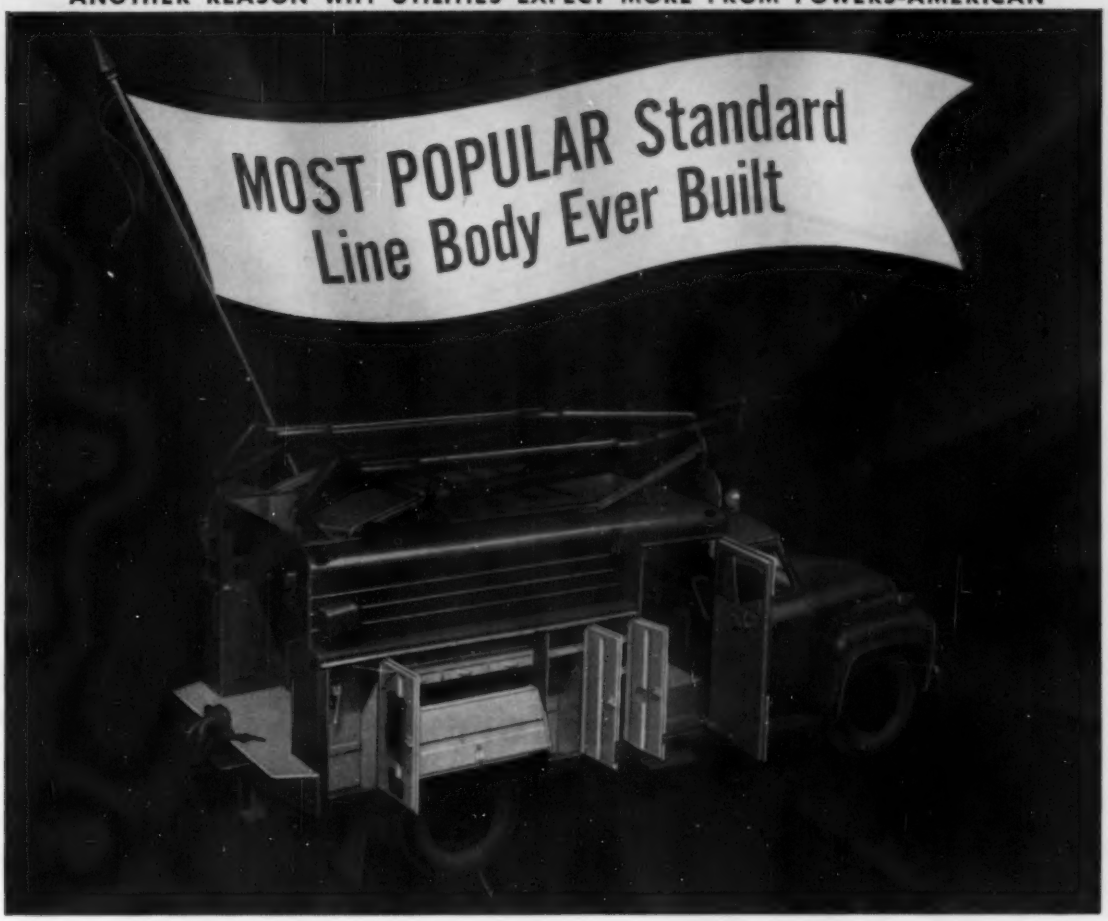
This book is a highly condensed but clearly written compilation of what the electrical engineer should know. It attacks subjects with fundamental theory and builds up quickly to advanced concepts. The second half of the work is devoted to the handling of circuit problems. A collection of network theorems is included, and symmetrical components, transients, and loci of complex functions are covered. The book is aimed at electrical engineers and students.

Warm Beds for Plants

Soil Warming by Electricity. By R. H. Coombes. Published by Philosophical Library Inc, 15 East 40th St, New York 16, N. Y. 116 pages, illustrated. Price $4.75.

Vegetable and flower gardeners can get higher prices for produce that matures early. Early ripening can be hastened in many cases by soil warming. This book describes briefly various heating techniques. Financial aspects also are discussed, but costs are expressed in English currency. Soil-warming details for some vegetables and fruits are sketched in one chapter. Flowers are treated separately. Brief discussions of intercropping and the future potential of soil warming round out the book. Some crops that do not respond to soil warming also are mentioned. This non-technical work is based on 5 years of experimentation by its author. Power salesmen may want to recommend it to commercial and amateur horticulturists.

ANOTHER REASON WHY UTILITIES EXPECT MORE FROM POWERS-AMERICAN



POWERS American® Series 800-C

LINE CONSTRUCTION AND MAINTENANCE BODY

"Isn't that a custom-made body?" That's what utility men often ask when they see the pace-setting 800-C. And, it's easy to understand why . . . for here's a body with more "most-wanted" features than any *standard* model on the market. Features such as partitioned sliding drawers, extra shelves, extra bins, "full-opening" doors, and 56" wide cargo area . . . just to mention a few.

Crews really go for the 800-C crew compartment—with its easy-riding seats, adequate leg room, and well-ventilated comfort in winter or summer.

Available in lengths of 11', 12' 3", and 13'. . . or without crew enclosure, in 11' and 12' 6" lengths. Can be furnished with any *Pole-Master* Hydraulic Derrick or with conventional derrick equipment.

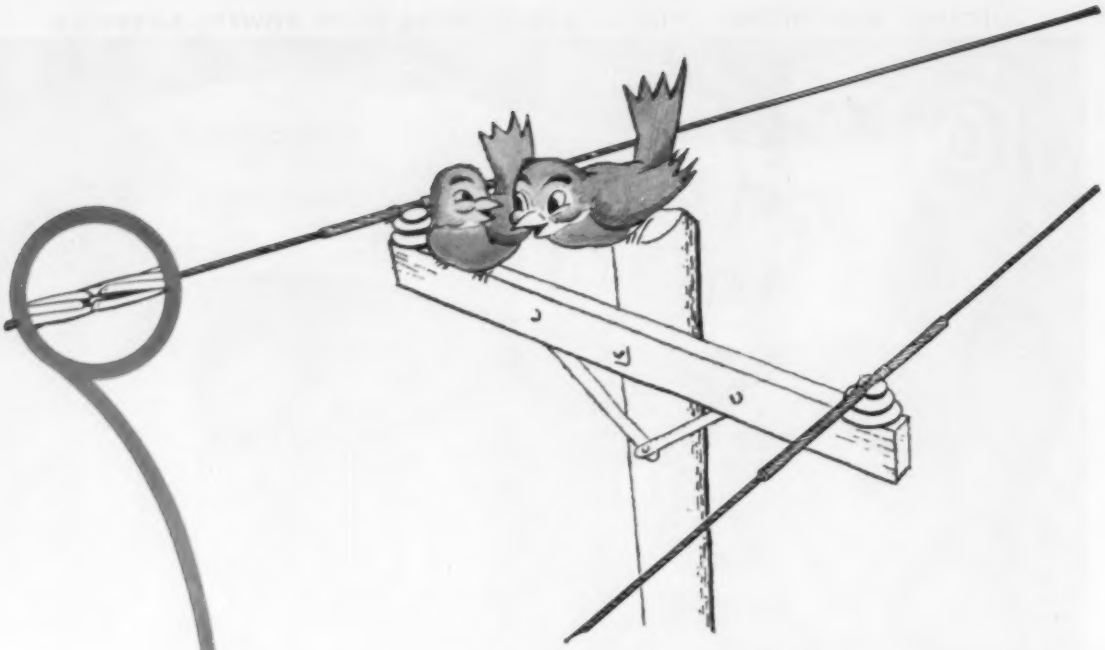
✦ Descriptive literature and prices will be sent on request

The Series 800-C Body shown here is equipped with a *Pole-Master* PM-2 Hydraulic Derrick . . . one of three different *Pole-Master* Derricks available in sizes for handling poles from 40' to 75' in length.

Powers-American Division

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. 625 CEDAR STREET • BERKELEY 10, CALIF.



"Glad They Know About Preformed Patch Rods"

All they need to do is wrap a set of Preformed Patch Rods over the damaged conductor. Patch Rods fully restore the tensile strength and conductance of the line.

Linemen know that Patch Rods are easy to install . . . tools are not needed—they simply wrap the rods onto the conductor with a motion similar to "wringing a cloth". Through intimate contact, Preformed Patch Rods become an integral part of the conductor.

Preformed Patch Rods are another example of how PLP progressive ideas are backed by *extensive research* and *sound engineering* to give you the ultimate in *field performance.*

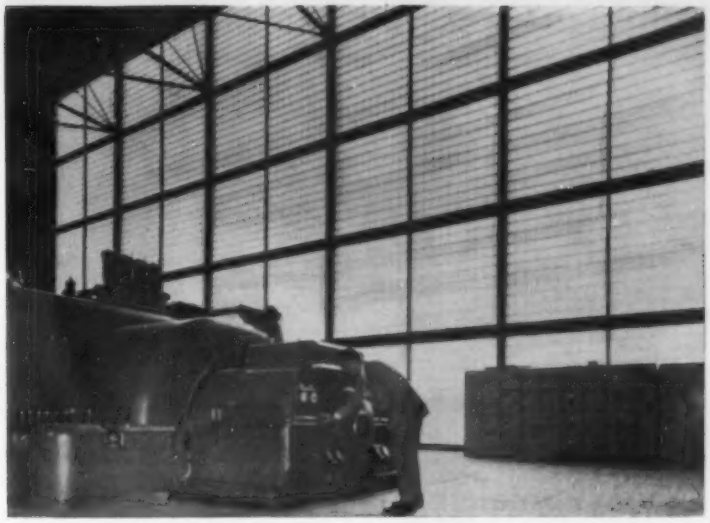
Consult Preformed Line Products or its Representatives for more information on the exclusive advantages of Patch Rods. Write or call Cleveland: EXpress 1-3571.

PREFORMED PATCH RODS

Made in accordance with or for use under one or more of the following U. S. Patents: 2,275,019; 2,587,521; 2,609,655; 2,691,865; other patents pending.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE **CLEVELAND 3, OHIO**



Glass Walls Shed Light in New Station

Glass blocks form the major section of the five-story walls at Philadelphia Electric Co's Cromby Station. In designing the window system, glass block panels were decided upon since they would give optimum lighting combined with high insulation value (equivalent of 8-in. masonry wall), and reduce window maintenance caused by storm damage, rust, and corrosion. Their durability is expected to match that of the building itself.

Glass blocks form the entire north and south walls of the huge room that houses the two generating units. Over 11,000 light-diffusing glass blocks, product of the Pittsburgh Corning Corp, are set in structural steel framework at each end of the generator room. The room itself measures 200 ft by 120 ft and glass blocks extend upward for 61 ft of the 78 ft height.

For ventilation, company engineers have designed a system with special louvers which gives ideal ventilating conditions at all times, regardless of outside conditions.

Westinghouse Extends Tests

Former practice of impulse testing some power transformers will be extended to all rated above 10,000 kva and above 69 kv

Westinghouse Electric Corp's transformer division is now quality control impulse testing all power transformers above 10,000 kva and above 69 kv.

In making the announcement, F. L. Snyder, vice president of the division, recalled that for 22 years Westinghouse has impulse tested transformers having a combined rating of more than 100 million kva.

"We are now extending our quality control impulse testing," Snyder added, "to include all power transformers rated above 10,000 kva and above 69 kv to provide added assurance to our customers of the uniform high quality and reliability of our transformers."

For ratings below 10,000 kva, and 69 kv, a high percentage of power transformers will continue to receive quality control impulse tests, Snyder said. "Impulse voltage problems are obviously simpler below 69 kv, and the excellent experience with these lower ratings indicates that testing on a sampling basis is more than adequate to assure high quality."

Snyder predicted that some type of impulse testing would be established as an industry standard for the larger ratings during the next few years just as low frequency tests are standard at the present time. "Prior to that time, however," he said, "we will provide this service to our customers as part of our normal test procedure on all large units."

The quality control impulse tests adopted by Westinghouse include application of the following impulse voltages:

1. A "reduced full wave" of voltage which is exactly the same shape as a full wave but at 50 to 70% values as a pattern wave.

2. Two "chopped" waves of voltage which rise to a crest value of 115% of the full wave value in 1.5 microseconds and are chopped or short-circuited within a few microseconds after the crest value is reached by allowing the voltage to spark over a parallel gap.

3. A "full wave" of voltage which rises to rated crest value in 1.5 microseconds and decays to half value in 40 microseconds.

Comparison of the "full" and "reduced" wave oscillograms should show identical shapes, demonstrating that the transformer has not been damaged and has passed the test.

Alcoa Plans To Expand Aluminum Wire Facilities

Aluminum Company of America plans to expand fabricating facilities at its Massena, N. Y., plant for the production of insulated aluminum conductors, according to a recent announcement by I. W. Wilson, Alcoa's president. The project is expected to cost about $1.7 million and will provide capacity for production of 10-million pounds of insulated aluminum wire.

An existing building will house the new facilities which will be completed in two stages. The first phase of the expansion will add equipment for covering three million pounds of wire annually, with production expected to begin in mid-1956.

The plant will have equipment to install a covering of plastic insulation on aluminum wire, and stranders for production of triplex cable.

(*Continued on page* 232)

Seal oil IN! Seal moisture OUT!

with

J-M TRANOLSEAL

developed especially for efficient sealing against

refined oils

You can stop the dangerous and costly leakage of oil from transformers and switchgear with Johns-Manville's Tranolseal sealing compound. This permanently plastic material has a nondrying vegetable oil base. It provides effective sealing action against air (dust and moisture), inert gas, water, 13% NaCl brine as well as medium to high viscosity refined oils. Thus you can also prevent penetration by moisture and other ambient sources of trouble.

Tranolseal has excellent adhesive qualities and will not corrode or deteriorate metals, rubber or plastics. It shows good resistance to weather and aging (both painted and natural) and won't stain. Furnished in 1" diameter beads. For further information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

JM

Johns-Manville
SEALING COMPOUNDS

Illinois Porcelain Aims to Insure Quality

To keep up with the demand for quality electric porcelain, Illinois Electric Porcelain Co, a division of McGraw Electric Co, has been hard at work developing new production equipment for its plant.

Among the items developed and installed are a hot press (illustrated) for pin-type insulators and a semi-automatic fettling for pin-type insulators. These machines, designed by manufacturing engineers of Line Material Co, another McGraw division, are reported to provide strict adherence to dimensional requirements. These machines, coupled with rigid quality control, further insure the production of porcelain products with consistent electrical and mechanical characteristics.

NEMA Reveals Wire & Cable Activities

Copper price and supply, trend towards super high-tension cables, modern high-voltage rubber insulation, thermal rerating of electrical equipment, dimensional tolerances of extruded insulation, and suitability of aluminum for magnet wire—these were some of the subjects discussed at the recent meeting of the National Electrical Manufacturers Association's Wire and Cable Section.

• Interest was focussed on a discussion by William A. Meissner, Jr., on the copper supply situation. Meissner, who is Deputy Director, Copper Division, Department of Commerce, said "It is increasingly apparent that the entire copper situation can be summed up in one word—Price. There is sufficent copper physically available to meet requirements", he said, "but there is not sufficient low price copper to meet them. This Administration does not favor price controls, nor do we believe that you do", he said.

"We have made an attempt to work with NEMA on all problems concerning the wire mill industry, and at present are working out a program in regard to surplus disposals," he said.

• Voltages of 138 kv to as high as 345 kv and possibly 400 kv will be used to transmit power from generating units 100,000 kw to as high as 350,000 kw, said R. J. Wiseman of Okonite Co. These units will be a part of the total generating capacity of about 200,000,000 kw in 1965. Wiseman stated that the electric cable industry is studying methods for improving the materials used for high-tension cable and electric utilities plan to conduct tests that duplicate operating conditions.

• Rubber insulated cables, especially in the 2 to 35-kv range, are being used more and more as the electrical industry expands. Output for Class 1 system will approximate 900 billion kwhr in 1963, stated G. J. Crowdes of Simplex Wire & Cable Co. Such a load will need efficient design of the

electrical, mechanical and thermal characteristics of rubber insulated power cable, said Crowdes.

• Thermal rerating of electrical equipment is being considered through revision of AIEE Standard No. 1, explained Ralph Hall, chief engineer of Phelps Dodge Copper Products Corp. The revision will incorporate basic performance tests as a measure of the suitability of insulation systems at higher temperatures, he said.

• A six-month trial will be a guide on a IPCEA proposed standard for dimensional tolerances of extended insulation, according to G. J. Crowdes, chief engineer of Simplex Wire & Cable Co.

• In the magnet wire industry aluminum has proven to be technically sound, said George Perkins of Reynolds Metals Co. Manufacturing problems have been met and solved, often in a manner that resulted in improved operations, he declared.

Synthetic Mica Plant Starts Production

Synthetic mica is now being produced by Synthetic Mica Corp at Caldwell Township, N. J., in the first plant designed solely for that purpose. The new company is a wholly owned subsidiary of the Mycalex Corp of America, Clifton, N. J., manufacturers of glass-bonded mica and ceramoplastic products.

The product is actually synthetic fluor-phlogopite (trade mark SYNTHAMICA) made from raw materials in plentiful supply in this country. These materials are put through an electric melting and crystalizing process which produces mica with high purity, thermal, optical and self-bonding properties. Resultant crystals exhibit the familiar ease of splitting but are presently limited to small sizes. Dielectric properties of single crystals are reported to be excellent. The main feature of synthetic mica is that its properties can be controlled in production to meet the requirements of the design engineer.

First bulk of synthetic mica produced will be pulverized and bonded with electrical glass to produce a ceramoplastic, an electrical insulation material that can withstand the effects of nuclear radiation and 1,000 F temperatures.

(*More M & M on page* 235)

Is your Company on this List?
American Gas & Electric Service Corp.
Appalachian Electric Power Co.
Indiana & Michigan Electric Co.
The Ohio Power Co.
Alabama Power Co.
Carolina Power & Light Co.
Central Maine Power Co.
Central Illinois Public Service Co.
Duquesne Light Co.
Dayton Power and Light Co.
Georgia Power Co.
Houston Lighting & Power Co.
Idaho Power Co.
Kansas Gas & Electric Co.
Louisiana Power & Light Co.
Monongahela Power Co.
Narragansett Electric Co.
New England Electric System
Niagara Mohawk Power Co.
Oklahoma Gas & Electric Co.
Omaha Public Power District
Pennsylvania Power & Light Co.
Philadelphia Electric Co.
Potomac Electric Power Co.
Southern California Edison Co.
The Cleveland Electric Illuminating Co.
Virginia Electric & Power Co.
West Penn Power Co.

These utilities use **dbpc**® antioxidant to give transformer oil longer life

New names are constantly being added to this list. More and more major utility companies are realizing that for peak efficiency, high-load transformers demand a sludge-free insulating oil. These utilities are turning to **dbpc**® (di-tert-butyl-para-cresol), since it greatly increases the resistance of transformer oils to oxidation and prevents sludge formation. For less than a cent a gallon, **dbpc** effectively inhibits new or reclaimed oil.

The large number of major utilities that use **dbpc** is reliable testimony to its economy and dependability. It's time you put your name on the list. In addition to its solid form, **dbpc** is available as IMPRUVOL 20® liquid inhibitor. Either can be used in transformers and circuit breakers.

For additional information, write to Koppers Company, Inc., Chemical Division, Dept. EW-105, Pittsburgh 19, Pa.

KOPPERS® **Koppers Chemicals**

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · ATLANTA
CHICAGO · DETROIT · HOUSTON · LOS ANGELES

Before Silicone Insulation, "over-motoring" was standard practice!

...but now you can match the load; let silicones carry the overload!

Overload capacity ranges up to 50% for Class H compared with 15% for comparable Class A motors.

that means

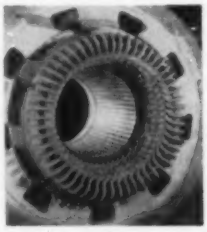
- ***more efficient use of motors.*** You can use the service factor built into silicone insulated motors to carry most initial or intermittent overloads or loads that can't be matched in standard frame sizes.
- ***smaller motors*** that require less magnetizing current and give you better power factor than ordinary motors of the same hp rating, because silicone insulation permits higher operating temperatures.
- ***more continuous production.*** Motor failure . . . down time . . . repair and replacement costs are reduced by *built-in* overload capacity and superior resistance to corrosive or abrasive atmospheres, high ambient temperatures and moisture.

Remember over-motoring is outmoded

For instance—

Allis-Chalmers gives you maximum overload capacity and maximum resistance to abrasion, moisture, vibration and to both electrical and mechanical fatigue in "Silco-Flex" insulated motors.

The Allis-Chalmers all silicone rubber insulating system made with Silastic*, is now available in most motors of 500 hp and larger. They offer longer life and more economical operation under severe operating conditions in power plants and mines, and in such continuous process industries as cement, chemical, food, paper and rubber manufacturing.



Dow Corning Corporation, Dept. 4410, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

☐ Information about Allis-Chalmers motors with Silco-Flex

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

DOW CORNING SILICONES

DOW CORNING CORPORATION

MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT
LOS ANGELES • NEW YORK • WASHINGTON, D.C. (Silver Spring, Md.)

CANADA: Dow Corning Silicones Ltd., Toronto
GREAT BRITAIN: Midland Silicones Ltd., London
FRANCE: St. Gobain, Paris

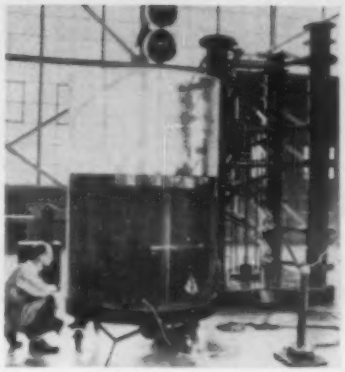
*TM REG. U.S. PAT. OFF.

Clear Plastic Tank Helps Test Transformer Coils

Packard Electric Co, Ltd, wanted to see what was going on when they subjected prototype transformer coils to breakdown tests, so they had an acrylic Plexiglas tank made for this purpose. The tank is shown at Packard's laboratory at St. Catherines, Ont.

Previously, Packard had been using a conventional steel vessel to hold the transformer oil in which the coils are submerged. Limited visibility made it difficult to detect exactly where and how breakdown was occurring. Furthermore, it was almost impossible to observe failure the moment it began to develop. Thus, it was frequently difficult to determine the exact voltage that caused breakdown.

The new tank was fabricated from ½-in. clear Plexiglas sheet, chosen for its dielectric properties and almost



total resistance to oils used as dielectric and coolant. The cylinder is 8 ft high and 5 ft in diameter. During tests, the tank contains 800 gal of transformer oil. Typical test currents imposed are 300 kv at 60 cps for one minute, and impulse voltages as high as 750 kv.

MANUFACTURERS' BRIEFS

Square D Co, Detroit, Mich., has opened its first eastern plant. It is located at Secaucus, N. J., and is the twelfth plant opened by the company. This new plant will serve the Middle and North Atlantic States, especially the New York Metropolitan area.

Westinghouse Electric Corp has begun a program of modernizing, re-equipping and enlarging portions of its plant at Springfield, Mass., for the production of compressors for room air conditioners. . . . The Lamp Division will add 66,000 sq ft to the sealed beam lamp plant at Fairmont, W. Va. . . . Control Division at Beaver, Pa., will add about 140,000 sq ft representing an increase of 25% in available manufacturing area.

SRIC—Sensitive Research Instrument Co has moved to 310 Main St, New Rochelle, N. Y., from 9 Elm Ave, Mount Vernon, N. Y. Some of the company's precision instruments are differential millivoltmeters, current instruments, galvanometers and ratiometers.

Bonneville Power Administration listed five bidders for eleven 230-kv power circuit breakers for which General Electric Co, bidding from Portland, Ore., was low at $822,400 fob destination. Six circuit breakers are for delivery to The Dalles, four to Bridgeport, Wash., and one to Covington, Wash., over period ranging from 365 to 515 days from award of contract.

Owens-Corning Fiberglas Corp is planning to construct a multi-million dollar plant on a 120-acre site near Camden, N. J., and the New Jersey Turnpike.

Admiral Corp is building a new electronic research laboratory at Palo Alto, Calif. A three-acre site has been leased for 99 years. Robert M. Jones will staff the laboratory when it is completed late this year.

General Electric Co has completed a $500,000 expansion of dc testing facilities in the Switchgear and Control Division laboratories at Philadelphia, Pa. . . . Ground will be broken late this year for a new building for the manufacture of room air conditioners; the sixth manufacturing building to be erected at Appliance Park, Louisville, Ky. . . . At Fort Wayne, Ind., GE recently completed a sound analysis laboratory which will have a library of noise. Here will be recordings of the murmurs of transformers and motors, to compare various noises so that noise sources can be isolated.

(*More M & M on page* 238)

Now: Like new!

G-E Service Shop

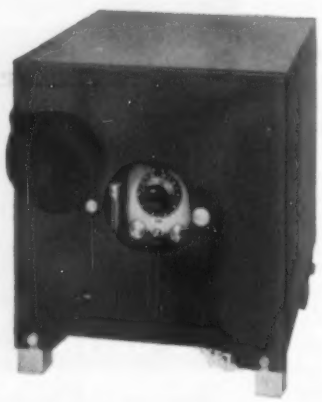
Your local G-E Service Shop uses mass-production methods when it rebuilds your old distribution transformers. Result: high-quality work at low cost . . . prompt pickup and delivery . . . and no worries for you. And you get new-unit warranties! There are 31 G-E Service Shops throughout the country—one near you. 451-32

Progress Is Our Most Important Product

GENERAL ELECTRIC

Get continuous, instantaneous records of system frequency and time deviation

. . . with this new *ElectroniK* instrument



NEW TIME DEVIATION DETECTOR
is practically error-proof

In this precision-built element, there are two synchronous motors. One is driven by line frequency, the other by standard frequency from the system's time standard. Both motors are geared to a differential mechanism. As long as both frequencies are identical, the differential stays stationary. When one motor goes faster than the other, the differential's floating spider begins to turn . . . its speed depending on the frequency difference. A Helipot slidewire connected to the spider transmits a d-c voltage determined by the spider position. This voltage, recorded by the *ElectroniK* instrument, is directly related to the system time error.

Precision-cut gears and ball-bearing mountings reduce friction to a minimum. Gears run in an oil bath . . . require no lubrication service.

★ **separate measuring systems:**

two independent pens, driven by separate "Continuous Balance" measuring circuits—one for frequency, one for time deviation. Dual scale calibration facilitates readings.

★ **continuous recording:**

every change in time deviation is measured and immediately recorded; no significant variations can go unnoticed. Continuous line record shows trends clearly.

★ **full-scale travel of both pens:**

both the frequency and time deviation ranges extend across the full width of chart and scale . . . afford maximum resolution of readings.

★ **shows accumulated time error:**

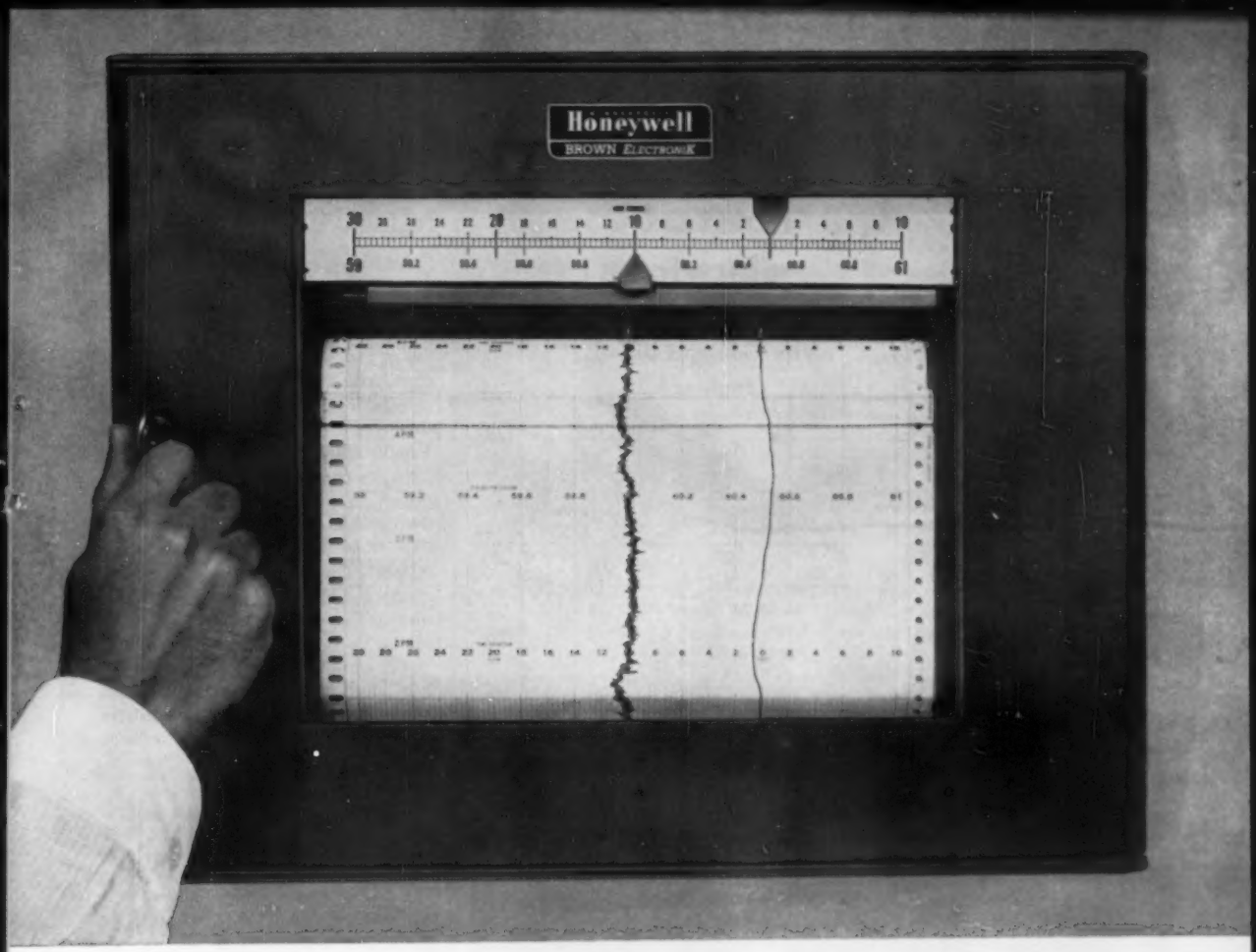
reads directly in seconds the total deviation between generator frequency and the system's standard time source.

★ **high accuracy:**

new time deviation detector and *ElectroniK* system together have precision within 0.1 second, exclusive of any error in the time standard. Accuracy of the frequency measuring system is within ±0.01 cps; measuring circuit can detect frequency changes as small as 0.005 cps.

★ **stays in synchronism:**

the recorder can be shut down temporarily for inspection of routine service without losing integrated time measurement. As soon as the recorder resumes operation, it reads total deviation correctly.



Now, system operators can have a more accurate and readable record of time deviation before them as a guide to correction of system time error. The new *ElectroniK* Time Deviation Recorder instantaneously measures and records both time error and frequency on the same chart. Each of these important variables is continuously drawn in readily legible detail—with a degree of dependability never before achieved.

The instrument embodies two separate "Continuous Balance" measuring systems . . . each operating a separate recording pen. The frequency system employs the improved pulse type measuring circuit based on *ElectroniK* components that have been in use in power plants for many years. For measuring time deviation, an entirely new detecting method is employed which offers exceptional accuracy and reliability . . . working with the industry-proved *ElectroniK* potentiometer.

Your load dispatchers and station operators will be able to improve supervision of system frequency with this *ElectroniK* recorder. Our local engineering representative will welcome the opportunity to discuss your specific requirements . . . and he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Instrumentation Data Sheets Nos. 9.1-8a and 9.1-14.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

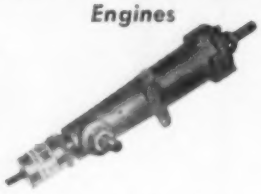
Time to Install

KIM Hotstart electric pre-heater

...for Gas and Diesel Engines

Advantages of KIM operation:

- ✓ Gives quick, easy starts
- ✓ Reduces motor wear
- ✓ Prolongs life of batteries
- ✓ Reduces fuel consumption
- ✓ Saves warm-up time
- ✓ Cuts cost of terminal heating
- ✓ For stationary or mobile engines — diesel or gas
- ✓ Four models — easily installed



It's this simple — equip your cars and trucks with KIM Hotstarts and you end major worries of winter operation. Engines purr like kittens. Starting is fast and smooth. You don't use as much fuel and you spend less on repair bills.

See your dealer or write for literature. Many of the smartest fleet operators in the country know KIM, use KIM, like KIM. Why don't you profit from their experience? Sold and installed by leading automotive suppliers.

KIM HOTSTART MFG. CO.
West 917 Broadway
Spokane 1, Washington

Manufacturers, Markets

(*Continued from page* 235)

Transocean Phone Cable to Link US-Hawaii

American Telephone and Telegraph Co and Hawaiian Telephone Co have plans for a submarine cable communication system connecting the United States and the Hawiian Islands. The repeatered, twin-cable system is scheduled for completion in 1958, and will supplement existing radio facilities. This system will have practically the same design as that of the transatlantic cable (EW, July 4, 1954, p. 56) and of the cable to be laid in 1956 between Port Angeles, Wash., and Ketchikan, Alaska. The latter cable will be supplied by Simplex Wire & Cable Co who furnished part of the transatlantic cable.

The eastbound section of the world's first transoceanic telephone cable across the Atlantic was completed recently. The westbound cable will be laid next summer.

Extends Crane Warranty

Coles Cranes, Inc, Joliet, Ill., is equipping all its mobile cranes with the Hobbs hour meter to indicate operating time. The meter will be used to implement the company's warranty which will be extended on the basis of 2,000 hr or 12 months which ever comes first. The one-man operated cranes range in capacities from 1.75 to 48 tons and are furnished with booms up to 30 ft long. They are gasoline or diesel electric type and are said to operate on as low as one gallon of gasoline per hour.

Bishop Offers New Tape

Latest product of Bishop Manufacturing Co's research program (EW, June 27, 1955, p.248) is a new self bonding electrical tape. Called Bi-Seal, Type 2, electrical tape, it is designed for use as the primary insulation for permanent, water-tight sealing of conductor joints in cathodic protection cables. With a jacketing tape applied to the outside, Type 2 is reported to offer both electrical and physical protection to cable joints.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co has announced new appointments in the sales organization of its Industries Group: V. L. Spinney, manager of New York district since 1949, has been named central region manager succeeding R. L. Halsted, new manager of the A-C processing machinery department; N. W. Landis, Detroit district manager since 1950, has been appointed New York district manager; A. J. Mestier, Jr, manager of Syracuse district for the past five years, has been designated Detroit manager; and John W. Becker has been advanced from sales representative to manager in Syracuse district.

Line Material Co has assigned P. J. Maloney to the Los Angeles office as fibre products sales engineer for California, Arizona, and Nevada. Previously Maloney was assistant to the product manager, fibre products, at L-M's main office at Milwaukee.

Pennsylvania Transformer Co has appointed Carl R. Boytano sales engineer in the New York office. For the past eight years he has been power equipment sales engineer for J. J. Costello Co, the New England sales representative for Pennsylvania Transformer.

Pittsburgh Reflector Co has promoted Paul F. Stiller from the Cleveland office to take charge of the Newton, Ohio, office covering Cincinnati, Columbus and the rest of southern Ohio, Kentucky, and most of West Virginia. Stiller will handle engineering, sales, and service for the line of Pittsburgh Permaflector fluorescent and incandescent lighting equipment.

Rome Cable Corp has announced the transfer of two sales representatives. R. D. Golly has moved from Chicago to the Los Angeles office, and T. C. Spriggs, from central New York State to the Chicago office.

Joseph T. Ryerson & Son, Inc, has appointed Henry B. Williams sales manager for the New York area steel service plant. He has been Ryerson's sales manager of tubular steel products and cold finished steel bars.

REPRESENTATIVES

J. F. Pritchard & Co of California, a division of J. F. Pritchard & Co, has appointed Cone & Wallace Co, Phoenix, Ariz., sales representative for Arizona.

Southern States Equipment Corp has appointed two sales agents. John H. Ormond Co, Oakland, Calif., will be representative in northern California and northern Nevada. G. L. Bleich & Co, Norfolk, Neb., will represent Southern States in Nebraska and western Iowa.

Superior Switchboard & Devices Co has named Robert A. Young & Co, Glendale, Calif., representative in southern California.

P-L ANCHORS HOLD FOREVER!

PIEPER-LILLARD, INCORPORATED
YORKTOWN 5-4811 • 122 N. KIRKWOOD RD. • ST. LOUIS 22, MO.
ORIGINATORS OF THE BENDING HINGE ANCHOR

P-L

a new, superior system of
CABLE and TUBING race ways
GLOBE'S CABLE WAY

A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Write for new complete catalog.
Distributors in all principal cities.
Contact the Grip-Strut distributor under "Grating" in the classified telephone directory.

THE GLOBE COMPANY
Manufacturers Since 1914
4000 S. Princeton Ave.
Chicago 9, Ill.

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THE GLOBE COMPANY
CHICAGO 9, ILLINOIS

AC WATTS
200 400 600 800
AC WATTS
200 400 600 800

FACT:

front accessibility of

Type 44 Recorder

makes servicing easier, faster

Easy to use and service—all parts fully accessible from front of recorder, a particular advantage in flush switchboard mounting.

Saves time—longer charts and greater ink capacity permit operation for longer unattended periods. Chart is more than 100 feet long, lasts up to 70 days.

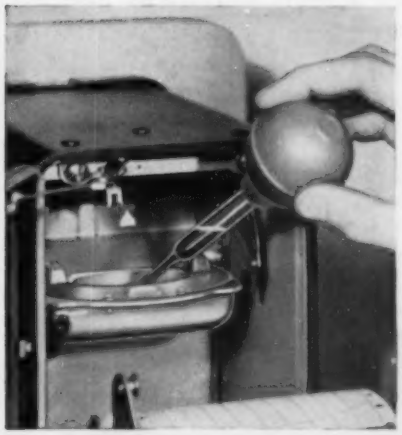
Saves switchboard space—highest ratio of scale width to panel area. Recorder is easy to read, has attractive appearance.

Westinghouse Type 44 Recorders are available in flush or projection-mounted cases, or portable models, for accurate, low-cost measuring of watts, vars, a-c voltage and current, d-c voltage and current, frequency and power factor.

FOR MORE FACTS: Call *The Man With The Facts* . . . your Westinghouse sales engineer. Or, get your copy of the facts booklet, B-5779, by writing directly to Westinghouse Electric Corp., 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa. J-40480

YOU CAN BE **SURE**... IF IT'S

Westinghouse



Inkwell swings forward for filling without disturbing the pen... scale automatically moves out of the way. Both inkwell and pen easily removed for occasional cleaning. Chart can be replaced quickly.

Removable shield protects the measuring element against spilled ink, dirt and damage . . . assures recorder dependability. This feature is particularly important in portable recorders. Shield may be removed readily with recorder in service.

Moving elements can be removed as a unit, without disturbing stationary elements, or field circuit. One-piece electromagnets assure correct scale distribution without adjustments, and permanent calibration.

D. B. POTTER

NEWS ABOUT PEOPLE

Potter Made Utility President

Monongahela Power Co has elected Don B. Potter president to succeed A. C. Spurr who will retire from the utility Oct. 31.

Potter has been associated with the company for 26 years. In 1952 he was made vice president in charge of power generation and was advanced to administrative vice president in 1954. He was recently elected president of Public Utilities Association of the Virginias (EW, Oct. 3, p. 188).

Spurr served as president for 20 years during his 30-year association with Monongahela and other affiliates of West Penn Electric System.

Lenhart Named Chairman

Cheyenne Light, Fuel & Power Co has advanced H. Hugh Lenhart from vice president and general manager to chairman of the board. His successor is Oliver P. Reed, operating superintendent of the company, subsidiary of Public Service Co of Colorado.

Lenhart held various executive posts with the parent company before joining Cheyenne LF&P in 1940 as vice president and general manager. He is a former president of Rocky Mountain Electrical League.

An electrical engineering graduate, Reed has served the Cheyenne utility since 1931 as district superintendent and operating superintendent.

L. J. Weber of the electric distribution engineering department of PSC of Colorado succeeds Reed as operations superintendent at Cheyenne.

H. H. LENHART

J. R. KETCHEL

Ketchel Heads Production for Two Utilities

J. R. Ketchel, Jersey Central Power & Light Co's general superintendent of electric production, has also assumed supervision of electric production for New Jersey Power & Light Co. Both utilities are subsidiaries of General Public Utilities Corp, New York City.

Ketchell succeeds Chief Engineer J. P. Mailler who has retired after 35 years with New Jersey P&L and other affiliates of GPU and predecessors. Ketchel's appointment was one of the steps in coordinating and integrating operations of the two New Jersey electric utilities.

In retirement Mailler will continue as consulting engineer during construction of NJP&L's office and service building at Denville.

Kerite Elects Smith Executive VP

Arthur H. Smith, vice president and director of Kerite Co, has been elected executive vice president of the company, manufacturer of insulated cable.

Smith joined Kerite in 1934 as a sales representative. He was named railroad sales manager in 1947 and vice president the following year. In 1951 he was elected a director of Kerite.

A. H. SMITH

(*More News About People on page* 246)

Why tie up your money in communications equipment?

When you let the Bell System furnish your communications, you enjoy three important advantages:

1. *You avoid a large capital investment.*
2. *You don't have to worry about maintenance and obsolescence.*
3. *You get the benefits of trained personnel, expert supervision, continuing analysis.*

You don't tie up your money in communications equipment when you use Bell System facilities. This means you free this money to produce income.

A Bell System communications engineer will be glad to survey your communication needs. His study and recommendations are yours without cost or obligation. Call your Bell Telephone representative.

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER MOBILE RADIO TELEMETERING AND REMOTE CONTROL CHANNELS

How to Control

FORMULA for Cutting Production Costs

(BAILEY Design) + (BAILEY Engineering) + (BAILEY Service)

= GREATER SAVINGS PER FUEL DOLLAR

Control Room at Highgrove Power Plant of California Electric Power Co., Riverside, Calif. In this "outdoor" plant Bailey Control of Combustion, Feed Water, Steam Temperature, Air Heater Temperature, and Fuel Oil Temperature, assists operators in producing low cost steam.

Units 1 & 2 are each rated at 320,000 lb per hr capacity, 850 psi, 900F. They may be fired with gas or oil.

Steam Cost

★ Close regulation of fuel and air input is vital to a strict control of your steam cost. But that's not all. You'll need control of other factors too. Your power costs can be held down only by controlling all of the important operations in your steam plant. That's where you can be sure of help from Bailey Controls. Here's why they can do the job and do it right:

1. Complete Range of Equipment—fully co-ordinated

You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, as might be the case if he had only a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience

No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you

Bailey Meter Company's Sales-Service Engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For close control of steam cost, more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More Power To You!"

A-118-2

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METER COMPANY
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CLEVELAND 10, OHIO
Complete Controls for Steam Plants

BAILEY METERS
Controls for
COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

R. B. CAPLES C. J. PARKINSON

Anaconda Ups Two Officials

Russel B. Caples has been elected vice president in charge of metallurgical operations for Anaconda Co, and C. Jay Parkinson has been elected vice president of Anaconda Aluminum Co.

A past president of American Zinc Institute, Caples remains president of Anaconda Aluminum, a post he has held since 1953. In his 46th year with Anaconda, he now succeeds Frederick Laist, retired, as vice president of metallurgical operations for Anaconda.

Parkinson has been counsel for Anaconda Co and subsidiaries for 14 years. He is a 1934 graduate of University of Utah's School of Law.

O'Brien, Dandrow Made VP's

Johns-Manville Corp has appointed John A. O'Brien vice president for Industrial Products Divisions and C. George Dandrow vice president of customer relations.

O'Brien will head the industrial products group comprised of three new divisions formed in a split-up of the present Industrial Products Division.

Appointed general managers of the new divisions are Francis J. Wakem, Packings and Friction Materials Division; Don L. Hinmon, Industrial Insulations Division; and Robert F. Orth, Pipe Division.

Hinmon and Orth have also been appointed vice presidents of Johns-Manville Sales Corp. Wakem has held that office since 1946.

Previously general manager of Industrial Products Division, O'Brien continues as a senior vice president of Johns-Manville Corp, a post he has held since 1951.

Dandrow previously served as general sales manager of the Industrial Products Division. He remains a vice president of Johns-Manville Sales Corp.

These appointments are effective Jan. 1, 1956.

J. A. O'BRIEN C. G. DANDROW

PERSONAL BRIEFS

Admiral Robert B. Carney, who retired recently as Chief of Naval Operations, has become a consultant to Westinghouse Electric Corp on development of military equipment.

Theodore F. Smith has joined Kaiser Engineers Division of Henry J. Kaiser Co as industry consultant. He recently retired after 17 years as president of Oliver Iron & Steel Corp . . . Anderson Brass Works, Inc, has named **R. C. LiBeau,** formerly of Bassick Co, Division of Stewart-Warner Co, plant manager of the company . . . **Charles F. Birchler,** sales department, Bailey Meter Co, has been appointed manager of the Central Station Division.

Richard G. Widdows has retired as board chairman of Electric Controller & Manufacturing Co, but continues as a consultant and director.

Ebasco Names Nuclear Head

Leonard F. C. Reichle has been named nuclear engineering director for Ebasco Services, Inc. He will head the Nuclear Engineering Division, recently formed to render atomic services to utilities.

Reichle resigned his post as assistant director of Atomic Energy Commission's Reactor Development Division to accept the nuclear directorate at Ebasco.

L. F. C. REICHLE

OBITUARY

M. O. Best, 53, chairman of the board for Arizona Public Service Co, died in Phoenix, Ariz. Named board chairman of the former Central Arizona Light & Power Co in 1945, he was instrumental in the company's purchase of Arizona Power Co. Best also helped bring about the merger of Calapco and Arizona Edison to form Arizona PS.

Hugh C. Thuerk, 59, died this month at Morristown, N. J. He was executive vice president and a director of New Jersey Power & Light Co and vice president and a director of Jersey Central Power & Light Co. Thuerk served as president of Bradford (Pa.) Electric Co, 1941-43, and president of New Jersey P&L, 1943-55.

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

OCTOBER

EDISON ELECTRIC INSTITUTE—Electrical Equipment Committee, Shoreham Hotel, Washington, Oct. 17-18.

AMERICAN WELDING SOCIETY—National Fall Meeting, Bellevue-Stratford Hotel, Philadelphia, Oct. 17-21.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Application of Motors to Space Heating and Cooling Equipment Conference, Chase Hotel, St. Louis, Mo., Oct. 19-20.

NATIONAL INDUSTRIAL CONFERENCE—Board Meeting, Waldorf-Astoria Hotel, New York, Oct. 20; Special Atomic Energy Conference, Waldorf-Astoria Hotel, New York, Oct. 26-28.

NORTHWEST PUBLIC POWER ASSOCIATION—Power Use Section, Seattle City Light Auditorium, Seattle, Wash., Oct. 20-21.

PENNSYLVANIA ELECTRIC ASSOCIATION—Systems Operation Committee, Hotel Harrisburger, Harrisburg, Pa., Oct. 20-21; Prime Movers Committee, Clearfield, Pa., Oct. 20-21; Electrical Equipment Committee, Hotel New Yorker, N. Y., Oct. 27-28; Relay Committee, Pocono Manor Inn, Pocono Manor, Pa., Oct. 31-Nov. 1.

OKLAHOMA UTILITIES ASSOCIATION—Accounting Section, Lawton, Okla., Oct. 21.

SOUTHEASTERN ELECTRIC EXCHANGE—Accounting Conference, Hotel San Carlos, Pensacola, Fla., Oct. 20-21; Sales Conference, Biltmore Hotel, Atlanta, Ga., Oct. 27-28.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—67th Annual Convention, Grove Park Inn, Asheville, N. C., Oct. 24-27.

AMERICAN STANDARDS ASSOCIATION—jointly with the National Bureau of Standards, 6th National Conference on Standards, Sheraton-Park Hotel, Washington, D. C., Oct. 24-26.

THE MAGNESIUM ASSOCIATION—Eleventh Fall Meeting, Hotel Biltmore, New York, N. Y., Oct. 31-Nov. 1.

NOVEMBER

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—Northeast Region Fall Meeting, Hotel Niagara Falls, Niagara Falls, N. Y., Nov. 1-3.

ASSOCIATION FOR APPLIED SOLAR ENERGY—World Symposium on Applied Solar Energy, Westward Ho Hotel, Phoenix, Ariz., Nov. 1-5.

EDISON ELECTRIC INSTITUTE—Taxation Accounting Committee, sponsored jointly with American Gas Association, Plaza Terrace Hotel, Cincinnati, Ohio, Nov. 3; Accident Prevention Committee, Beaumont Hotel, Beaumont, Tex., Nov. 13-18; Industrial Relations Committee, Joint Meeting with New England Personnel Group, Somerset Hotel, Boston, Nov. 17-18.

PACIFIC COAST ELECTRICAL ASSOCIATION—Business Development Section Annual Conference, Huntington-Sheraton Hotel, Pasadena, Calif., Nov. 3-4; Hawaiian Section Conference, Reef Hotel, Honolulu, Nov. 9-10; Administration Services Section Meeting, California Hotel, Fresno, Calif., Nov. 16-17.

***CONTROLLERS INSTITUTE OF AMERICA**—24th Annual Conference, Hotel Statler, Los Angeles, Nov. 6-9.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Eastern Joint Computer Conference, Hotel Statler, Boston, Nov. 7-9.

INDUSTRIAL MANAGEMENT SOCIETY—19th Annual Time and Motion Study and Management Clinic, Sherman Hotel, Chicago, Nov. 9-11.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Diamond Jubilee, Congress, Hilton & Blackstone Hotels, Chicago, Nov. 13-18.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Annual Meeting, Traymore Hotel, Atlantic City, Nov. 14-18.

CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING—Chicago Coliseum, Nov. 14-18.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES—Cable Engineering Section, Bellevue-Stratford Hotel, Philadelphia, Nov. 17.

***NATIONAL INDUSTRIAL CONFERENCE**—Board Meeting, Bellevue-Stratford Hotel, Philadelphia, Nov. 17.

INTER-INDUSTRY FARM ELECTRIC UTILIZATION COUNCIL—2nd Annual National Power Use Workshop, Chase & Park Plaza Hotels, St. Louis, Mo., Nov. 28-30.

ELECTRIC COMPANIES ADVERTISING PROGRAM—Copy Group Meeting, Ayer Studio, New York City, Nov. 30.

AIR CONDITIONING & REFRIGERATION INSTITUTE—9th Air Conditioning & Refrigeration Exposition, The Auditorium, Atlantic City, N. J., Nov. 28-Dec. 1.

DECEMBER

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS—51st Annual Meeting, Hotel Traymore, Atlantic City, Dec. 1-3.

NATIONAL ASSOCIATION OF COST ACCOUNTANTS—Fairmount Hotel, San Francisco, Dec. 2-3.

AMERICAN WATERSHED COUNCIL, INC—Second National Watershed Congress, Statler Hotel, Washington, D. C., Dec. 5-6.

INTERNATIONAL EXPOSITION—25th Exposition of Chemical Industries, Convention Hall, Philadelphia, Pa., Dec. 5-9.

ENGINEERS JOINT COUNCIL—Nuclear Engineering & Science Congress, Public Auditorium, Cleveland, Dec. 12-16.

EDISON ELECTRIC INSTITUTE—Industrial Relations Committee, EEI Headquarters, N. Y., Dec. 15.

JANUARY 1956

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter General Meeting, New York, Jan. 30-Feb. 3.

FEBRUARY

EDISON ELECTRIC INSTITUTE—National Industrial Electric Heating Conference, Netherland Plaza Hotel, Cincinnati, Feb. 6-10.

***ROCHESTER ELECTRICAL ASSOCIATION**—Electrical Exposition, War Memorial Building, Rochester, N. Y., Feb. 18-25.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, Feb. 27-March 2.

* Additions this week.

Southeastern Exchange Slates Sales Conference

"Selling, That Will Click in Fifty-Six" is the theme for Southeastern Electric Exchange's sales conference, scheduled Oct. 27-28 at Biltmore Hotel, Atlanta, Ga. A general sales conference will be held Oct. 27, and various committee meetings are slated for the following day.

Harllee Branch, Jr, president of Edison Electric Institute and Georgia Power Co, will deliver the welcoming address. The "Necessity for Increased Sales Efforts" will be discussed by W. J. Clapp, president of SEE and Florida Power Corp, in a luncheon speech Oct. 27.

Full-day sessions of these committees will take place Oct. 28: public and employee information, residential and rural sales, industrial power, commercial load building, and agricultural development.

New Award for Utilities

A new award to electric companies for educational activities on the light-and-sight theme will be presented for the first time at the next sales conference of Edison Electric Institute. Known as the Better Light Better Sight Bureau Award for Lighting Education, two bronze plaques will be awarded. One will go to an electric company with more than 250,000 meters; the other, to a company with less than that number.

GENERAL ELECTRIC ANNOUNCES . . .

FIRST 1200 TO 4000 AMPERE INSTRUMENT TRANSFORMER FOR INDOOR/OUTDOOR USE

TYPE JCP-0 FEATURES BUTYL-MOLDED CONSTRUCTION

General Electric's butyl-molded line of current transformers has been extended to include the new 600-volt JCP-0. This new indoor/outdoor transformer features an ampere range of 1200:5—4000:5, plus many outstanding features.

INDOOR AND OUTDOOR APPLICATION of the JCP-0 offers you a definite cost-saving advantage. This new high current transformer fulfills both indoor and outdoor requirements, thus reducing inventory and initial purchase costs.

BUTYL-MOLDED CONSTRUCTION of the new G-E transformer provides an insulation that resists oxidation, tracking, and moisture, and is not easily damaged by accidental rough handling.

WINDOW-TYPE DESIGN is offered for through-type installations. The 5⅜-inch window allows easy insertion of primary cables.

The JCP-0 meets the highest industry accuracy standards: **0.3 B-0.1** to B-2 inclusive.

For more information contact your nearest G-E representative or write to Section 581-1 for Bulletin GEC-1348, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ACTUAL SIZE
General Electric's new high-current JCP-0 instrument transformer is smaller and lighter than older designs for comparable service.

STEEL

Every Kind

Quick Delivery

Plates, Structurals,
Bars, Sheets, Tubes, etc.
Carbon, Alloy, Stainless
Steels, Babbitt Metal.

RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Charlotte, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Milwaukee, Chicago, St. Louis, Seattle, Spokane, Los Angeles, San Francisco

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Remember . . . in the dynamic electric power industry, only World® can do

World's® work . . .® **Electrical World**

that is . . .

·ANSONIA·

Ankoseal® Cables of Quality

• THE ORIGINAL ALL PLASTIC CABLE •

provide distribution circuits

deliver power to homes and factories

The quality of Ankoseal is insured by rigid controls during manufacture. The results are high dielectric strength, dependability, long service life and quality service at low cost. Made for aerial, duct and direct burial installations. *Write for information on specific installation requirements.*

THE ANSONIA WIRE & CABLE COMPANY

ANSONIA • CONNECTICUT

Fast Depreciation

(*Continued from page* 108)

to credit on its balance sheet to an earned surplus account entitled 'Earned Surplus Restricted for Federal Taxes on Income,' the amounts of tax 'savings' or 'deferrals' resulting by the utilization of the accelerated depreciation provisions of the federal income tax laws could be detrimental to sound public utility regulations; therefore the commission finds that it should not grant its consent and authority, as requested by the instant application."

Identical language was used in the Cincinnati Gas & Electric Co order.

CEI Permitted Reserve Method

The Cleveland Electric Illuminating Co order which was issued last (Sept. 13, 1955) of the three orders ostensibly permitted the company to normalize taxes and to use the reserve method of accounting. However, the way the order is written, there would appear to be some doubt as to whether the company in reality got an accounting order at all.

In its findings the PUC stated that there would be a reduction in taxes in the early years depending upon the nature and the rate of addition of facilities. It should be noted that no mention was made of any deferral, merely that there would be a reduction in taxes. The commission went on to say that funds arising from such a reduction should not be paid out in dividends.

Normalized Taxes, an Expense

As to taxes being normalized it would appear from the commission's findings that they would be allowed as an expense. Thus the PUC findings read:

"That the appropriate account treatment is to make an additional charge to operating expense annually in the amount by which federal income taxes for the year resulting from the election of accelerated depreciation in respect to any of its properties, differ from the federal income taxes which would have resulted had the company not elected such accelerated depreciation, and

"That the corresponding credit in the balance sheet should be made to an appropriate liability account other than restricted surplus, and

"That pending further determination by this commission such credit

should be made to a special reserve."

While it says that the net difference (ie, reduction) in taxes is to be credited to a special reserve, no mention is made of any corresponding charge to income either above or below the "line."

PUC in concluding order noted: ". . . nothing herein shall be construed as being an approval by this commission of the reasonableness or justness of any rate, charge, rule or regulation filed with the commission, nor binding upon this commission in any future proceedings regarding the reasonableness or justness of any rate, charge, rule or regulation."

The heavy qualifications in the last paragraph are especially noteworthy in view of the possible action which the executive Committee of the NARUC may have to take on the Colbert Report next week.

Uranium-Rich Moab Area Made New UP&L District

The uranium-rich Moab area has been designated a separate district in Utah Power & Light Co's Southern Division.

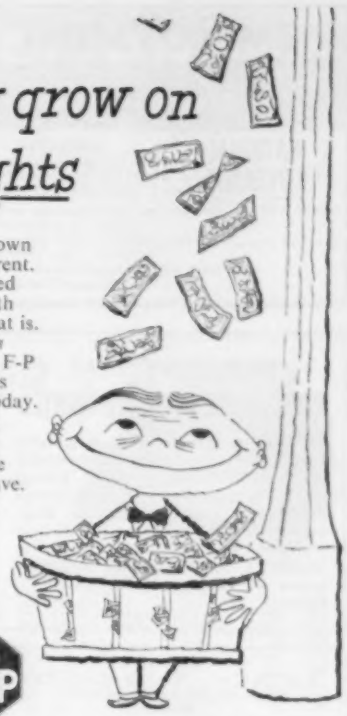
The district will serve the areas supplied by the million-dollar transmission system UP&L is building into southeastern Utah. Towns included are Moab, Green River, Monticello, Crescent Junction, La Sal, Sego, and Thompsons.

Richard M. Pizza, an electrical engineering graduate of Washington State, is in charge with headquarters in the uranium mining center of Moab. Creation of the new district is justified by the atomic-age boom in the area.

Canada Reactor Contract

Contract to design a "swing" type reactor has been awarded Canadair, Ltd, of Montreal by Atomic Energy of Canada, Ltd. The new reactor, similar to the "swimming pool" type and costing between $250,000 and $300,000, will be used at Chalk River in connection with Canada's power reactor research and development program. Canadair, a subsidiary of General Dynamics Corp, has been engaged in airplane manufacturing since it was founded 13 years ago.

making money grow on .....streetlights



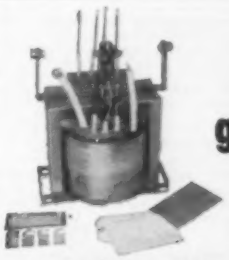
Although no one as yet has grown money on trees, *streetlights* are different. At least when some economy-minded utility engineer has equipped them with Fisher-Pierce photoelectric controls, that is. On low *first* cost, on reduced *installation* cost, and minimum *maintenance* cost, F-P units are producing substantial savings for the hundreds of utilities using them today.

The F-P *Series 64400* control is a good example. Low initial cost and infrequent repair make it practical to use *one 64400 per lamp*, as many utilities have.

Add to this economy the *basic* advantages of F-P photoelectric lighting controls: light *when* it is needed, independent of time, season or weather; *dependable* operation, a result of Fisher-Pierce's ten years of experience in this field. Facts and figures for the asking.

THE FISHER-PIERCE COMPANY, INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT: Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.
In Canada: Northern Electric Co., Ltd.



Complete Replacement Kit

When you replace CORE & COILS get original factory quality

ALLIS-CHALMERS CORE and COIL Replacement Assemblies

Allis-Chalmers core and coil assemblies are dried, assembled and tested at the factory using the same skill and advanced equipment as on standard A-C distribution transformers. They can be used in any make tank.

All replacement units are packaged under oil in a specially designed metal drum that protects against moisture and damage during transportation. Complete instructions for installation are enclosed with each unit.

Assemblies are available in ratings 25 kva and smaller and conform strictly to NEMA standards. They can be used either in conventional or protected types. Provisions for mounting low voltage breakers and windings to operate signal light are standard.

Special Moisture-Proof Package

Easy to Install 4 Simple Steps

Get the facts by calling your nearby A-C office or writing Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 61B6345A. A-4556

ALLIS-CHALMERS

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant | Civil Service Opportunities | Employment Agencies
Positions Wanted | Selling Opportunities Wanted | Employment Services
Part Time Work | Selling Opportunities Offered | Labor Bureaus

NATIONAL COVERAGE

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for October 31st issue closing October 21st

EXECUTIVE TYPE
SALES REPRESENTATIVE WANTED

Excellent opportunity for aggressive man to join large manufacturer expanding in field of preservatively treated forest products. Domestic and foreign distribution. College degree in Engineering and/or experience in this field preferred—age 28-35. All replies in confidence. Address—Sales Representative. P. O. Box 1426, Houston 1, Texas.

WANTED
ELECTRICAL UTILITY ENGINEER
WITH DISTRIBUTION EXPERIENCE
Write:
Chief Electrical Engineer
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY
SPRINGFIELD, ILLINOIS

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITIONS VACANT

Sales Engineering excellent career opportunities for several electrical engineers, recent graduates to age 30. Nationally known wire and cable manufacturer will train you for sales engineering positions. Previous sales experience not required. Training at plant located in Northeast. Placement will be in branch offices throughout U. S. Reply giving age, education, include recent photo. P-7724, Electrical World.

Sales Engineer, technical electrical graduate to cover territory 200 mile radius from New York. Excellent opportunity for man with executive ability, capacity for growth and a sound practical and theoretical engineering knowledge. Reply giving age, experience, etc. P-7959, Electrical World.

Electrical Engineer—Permanent supervisory position in the electrical inspection division of the City of Detroit. Experience desirable in plan examination of lighting and power distribution installations. Starting salary $6382, increases to $7228. For further information write Detroit Civil Service Commission, City-County Building, Detroit 26, Michigan.

Young Electrical Engineer—Power Option.— Recent graduate or man with one or two years experience. Good opportunity. Permanent position with long established electric utility in Costa Rica. Knowledge Spanish necessary. Reply, stating age, education, experience, personal particulars, and minimum salary expected. P-7987, Electrical World.

Electrical Engineer—graduate two to five years experience protective relay work with electric utility. Permanent position long established Supervisory—Consulting Organization. Headquarters New York. Some travel Latin America. Salary commensurate with experience. Reply, stating age, education, experience, personal particulars and minimum salary expected. P-7993, Electrical World.

GRADUATE ELECTRICAL ENGINEERS
Qualified to handle complete power plant electrical engineering. Age under 45.
TO ARRANGE FOR AN INTERVIEW
Please Write MR. W. GARVEY
GIBBS & HILL Inc.
461 EIGHTH AVE. (33RD ST.)
NEW YORK 1, N. Y.

ENGINEER-CONSULTANT
Excellent opportunity for man of technical training and broad experience in electric power public utility field, including thorough experience in steam electric plant design and operations. State age, education, experience and general qualifications. Small recent photograph desirable. Replies considered confidential.
MIDDLE WEST SERVICE CO.,
Att. Engineering Dept.
20 N. Wacker Drive Chicago, 6, Ill.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo, N. Y.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4535) will be received at Denver, Colorado, until November 1, 1955, for furnishing three (3), 12,000-kva, 13,200-volt (15,000-volt insulated), 3-phase, 60-cycle, class OA or AA, outdoor, shunt reactors for Fargo, Watertown, and Granite Falls Substations, Missouri River Basin Project, North and South Dakota. Delivery is desired within 120 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

Don't forget the
Box Number

WHEN answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

SEARCHLIGHT SECTION

(Classified Advertising)

(Continued on opposite page)

FOR SALE

2—15 H.P. Motorized Speed Reducers 1750 to 42 RPM, 220/440 V 3 ph 60 cy
5—20 H.P. Ditto but 1750 to 37 RPM
15—25 KVA West. Dry Type Transformers 2400/4160 to 120/240 V.
7—10 KVA Ditto
9—25 KVA G.E. Pyranol Transformers 2400/4160 to 120/240 V.
1689 ft. #1-3 cond. 3000 V. Neoprene Copper Cable
12,000 ft. #8-3 cond. 3000 V. Neoprene Copper Cable
902 ft. #4-3 cond. 3000 V. Neoprene Copper Cable

7—40 H.P. Wound Rotor Motors 900 RPM 220 V.A.C.
1—50 H.P. Wound Rotor Motor 900 RPM 220 V.A.C.
5—75 H.P. Squirrel Cage Motors 1800 RPM 2200 V.A.C.

10 Capacitors 7½ KVA 230 V 3 ph 60 cy.
11 Capacitors 15 KVA 2400 V 1 ph 60 cy.

1—4500 Watt Office heater 230 V.
3—3000 Watt Office heaters 230 V.

RODEN COAL COMPANY
MARVEL, ALABAMA

FOR SALE
VACUUM PUMP

Kinney 500 CFM capacity, Model DVD-14141S, high vacuum pump, complete with standard oil seal and separator tank. V-Belt drive for pumping motor, mounted on steel base, connected to and driven by 25 h.p., 1200 r.p.m., 220-440 volt, 3-phase, 60 cycle motor, including solenoid valve for oil feed line. Like new condition—purchased in 1952 and used in production less than 30 hours. May be inspected under power at our plant.

Wells Specialty Company
INC.
NORTH LIBERTY, INDIANA

ELECTRICAL WIRE AND CABLE
—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced
One of the Largest Stocks in the Midwest
Let us quote on requirements—send your inquiries
We'll also buy your Surplus
Branch Offices:
Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION
UNIVERSAL Wire and Cable Co.
2664M N. Clybourn Ave., EAstgate 7-4777
Chicago 14, Ill. Code: UNIWIRE

PERIODICALS

A.I.E.E. transactions back-volume wanted to buy for cash. Ashley, 24 E. 21, N.Y.C. (10).

WANTED

ANYTHING within reason that is wanted in the field served by Electrical World, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO: 330 W. 42 ST., N. Y. 36, N. Y., for October 31st issue closing October 21st

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
3	1000	Mol.	110,000—460
1	3750	West.	69000—14400, 3 ph.
4	2500	Mol.	66000—13800
4	750	G.E.	66000/114000—13200
4	500	West.	69000—6900
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900
3	1250	A.C.	44000/11500—460
3	200	West.	44000—480
3	75	Est.	44000—7200/12470 Y
1	7500	A.C.	39838/69000 Y—13200, 3 ph.
3	5000	G.E.	38100/66000—6600
1	3750	Penna.	38030/65865 Y—13800, 3 ph.
4	3333	G.E.	38100/66000 Y—33000
4	3125	Mol.	39900/66000 Y—26600/46000 Y
6	2000	Mol.	38100/66000 Y—13800
3	5333	G.E.	33000/11000—2400/7200
1	3000	G.E.	33000—6900/2300, 3 ph.
2	3000	Stand.	33000—4160, 3 ph.
1	2500	A.C.	34500—13800, 3 ph.
1	2000	Kuhl.	33000—6900, 3 ph.
3	667	A.C.	33000—2400/4160 Y
3	200	A.C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph.
3	2000	G.E.	26400/13200—2400
3	1250	G.E.	26400/13200—2400
4	1500	A.C.	25400/44000 Y—6900/13800
3	333	G.E.	22800/13200—2400
3	100	G.E.	22000—7200/12470 Y
2	3000	G.E.	13800—600 3 ph. Unit Sub.
3	1200	West.	13800—600 3 ph. Unit Sub.
1	1000	West.	13200—2300, 3 ph. Unit Sub.
1	600	Stand	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G.E.	13200—2400
4	500	Mol.	7200/12470 Y—2400/4160 Y
4	167	G.E.	7200/12470 Y—2400
3	125	A.C.	6900—2300
3	37½	G.E.	6900—230/460
3	333	G.E.	2400/4160Y—460
3	250	G.E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G.E.	2300—575, 3 ph.

ALSO:—FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYN. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, ETC.

BREW, WOLTMAN & CO., INC.

52 Church St. New York 7, N. Y.

"SEARCHLIGHT"

IS

Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"

DIESEL POWER

IMMEDIATE SHIPMENT

• PURCHASE OR RENTAL

UNIT CAPACITIES—10 TO 2475 KVA

A.C.—50 AND 60 CYCLES

• ALSO D.C. UNITS

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1180	Worthington	SEH-8	1665	300	230	Superior	60E-6	460	450
1136	Fairbanks Morse	38D	1600	720	200	Fairbanks Morse	32E14	450	300
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	450	1200
1000	General Motors	16-567B	1440	720	250	Clark	GD-4	375	360
750	General Motors	12-567	1080	720	200	General Motors	8-268A	350	900
700	Worthington	EE-6	1000	327	175	General Motors	12-71	275	1800
675	Fairbanks Morse	38D	960	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	148	Fairbanks Morse	32E14	220	300
500	Alco	6-12jx13T	750	600	100	General Motors	3-268A	150	1200
350	Baldwin	VO-6	510	450	60	General Motors	6-71	90	1200
320	Enterprise	DSG-6	460	450					

A. G. SCHOONMAKER COMPANY, INC.

DIESEL DIVISION, 50-52 CHURCH ST., NEW YORK 7, N. Y.

MOTOR GENERATOR SETS

KW	MAKE	A.C.	D.C.
1000	G.E.	13200	600
500	Westg.	2300	250
400	Al.-Ch.	2300	120/240
400	G.E.	2300	270
300	G.E.	2300	250
200	G.E.	2300	250/275
200	Westg.	4160/2200	275
200	Ridgeway	2300	250
170	G.E.	440	125
150	Al.-Ch.	2300	275
150	Westg.	2300	125/150
150	G.E.	440	275
100	G.E.	2300	250
100	Westg.	440	125
100	G.E.	440	125
75	Al.-Ch.	440	250
75	G.E.	440	125

CHICAGO ELECTRIC CO.

1324 W. Cermak Rd. Chicago 8, Ill.

Save Money — Save Time

Contact us for prices, on large power equipment of all kinds. Prompt shipment from inventory. Send for our complete catalog.

BELYEA COMPANY INC.

51 Howell St. Jersey City, N. J.

MOTORS · GENERATORS
TRANSFORMERS
NEW · REBUILT
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT CO.
PHONE STATION COLLECT GL 6780
P.O. BOX 51 ROCHESTER 1, NEW YORK

TRANSFORMERS

FOR SALE

3—1000 Kva Mol. 11500-2400/4160Y
3— 500 Kva W-H 33000-2300/2400
3— 500 Kva G-E 22000-2300/4000Y
5— 333 KVA W-H 38200-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/11950Y
3— 333 KVA G-E 7200/12470Y-2400/4160Y
3— 333 Kva Wagner 6900/11950Y-7200/12470Y
3— 150 Kva G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 100 KVA G-E 13200-230/460

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

PUBLIC RELATIONS AND ADVERTISING

ECAP Ad Quotes PG&E Chairman

The Electric Companies Advertising Program ad for October has chosen for its subject extracts from the excellent speech made last summer by James B. Black, chairman of Pacific Gas & Electric Co, before the Edison Electric Institute convention.

Black notes that it is "not a coincidence that the only areas of potential (electric) power scarcity in the United States are those in which government has assumed to itself a dominant role." He also points out that "It is little wonder that with a tremendously unfair tax advantage the government is often able to undercut its own citizens in the marketing of power."

The advertisement will make its first appearance in Editor & Publishers, October 29, and subsequently will appear in Broadcasting-Telecasting, Publishers Auxiliary, and American Press.

MINIATURE POWER SYSTEM demonstrator is proving a real crowd stopper for Indiana & Michigan Electric at fairs and exhibitions in company's service area

PR & AD BRIEFS

Arkansas Power & Light Co has given the "new look" to its quarterly memo to stockholders. It now takes the form of a newsletter. It is called "Lines from the Land of Opportunity." The newsletter is enclosed with dividend checks and is mailed to leaders of business, agriculture, education, and the professions in Arkansas. For copy write Joe Leroux, advertising department, Arkansas Power & Light Co., Little Rock, Ark.

Cleveland Electric Illuminating Co is sponsoring Edward R. Murrow's "Person to Person" TV show on WXEL in Cleveland . . . **Central Hudson Gas & Electric Corp** has signed a 26-week contract with Station WKNY-TV in Kingston, N. Y., to sponsor the latest national and local weather forecasts each evening Monday through Friday from 7:25 to 7:30 PM.

General Electric Co has enshrined a 52-year-old electric power transformer at its medium power transformer plant at Rome, Ga. This transformer was located at Pacific Gas & Electric Co's substation, near Santa Cruz, Calif. It was the oldest operating model to be located in a nationwide "treasure hunt" conducted last year by GE. PG&E received as a treasure hunt prize a brand new replacement transformer manufactured in the Rome plant.

West Penn Power Co is circulating to 16,000 industrial firms as well as to 600 realtors and consulting engineers in U. S. a folder showing how western Pennsylvania is meeting plant location requirements for all types of industry. For copy write Charles M. Fife, manager, area development, West Penn Power Co, Box 1736, Pittsburgh, Pa.

Kansas Gas & Electric Co is using the theme "Electric Cooking is So-o-o Clean" this month in advertisements appearing in local newspapers.

United Illuminating Co is running an advertisement in local newspapers on how easy it is to enter the company's "Adequate Wiring Slogan Contest." There are two identical contests with identical prizes, one for the New Haven Division and one for the Bridgeport Division.

look beneath the braid

...that's where quality begins

the seamless construction of Rockbestos A.V.C. means lower long-range cost through long, dependable service

Heavy, felted asbestos walls are applied over and under the varnished cambric tapes . . . then thoroughly impregnated . . . then the impregnated asbestos is compressed to a dense, homogeneous wall that ensures long cable life.

N.E.C. Type AVA wires or cables may look alike on the surface. But the proof of their quality is *under* the braid. Look for the dense, uniformly-impregnated, seamless walls of *Rockbestos A.V.C.* Type AVA.

The dense, felted, thoroughly-impregnated asbestos walls of *Rockbestos A.V.C.* seal the varnished cambric tapes away from air or moisture. This seamless construction gives *Rockbestos A.V.C.* added strength against damage from flexing. Heat dissipation is uniform. Dielectric strength *stays* high under conditions of high ambient temperature or moisture.

Complete construction and test specifications of *Rockbestos A.V.C.* Type AVA are in the new booklet: "Specifications RSS-88". Write for your copy.

STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

ROCKBESTOS PRODUCTS CORP.
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS • LOS ANGELES • NEW ORLEANS • OAKLAND, CALIFORNIA

READERS FORUM

Standard Terminology—Chilean Style

To the Editor:

In your Aug. 1 issue you asked for ideas on a standard terminology. English is not my native language; but having read many technical publications written in English, I have built up some opinion about technical terminology. Here it is:

Boiler or "steam generator"—I have a definite conception about a "boiler." Not so about a "steam generator."

"Heat pump" or "electric air conditioning"—I don't remember which was the original name Lord Kelvin had in mind for his brain-child. But I believe that "heat pump" comes very close to what it really is. An electric heater is a means for electric air conditioning too, but it is not a heat pump.

"Turbogenerator" or "turbine generator"—The first expression of course. It's more "international." In Spanish we say "turbogenerador," Germans call it "turbogenerator," and French "turbogenerateur." I would say, a turbine generator is something that generates turbines like General Electric or Westinghouse.

"Adequate wiring" or "wired for electrical living"—No opinion. In South America we are still too far away from electrical living.

Boiler rating—"Boiler megawatts" would be at last a precise term for boiler capacities the world over as watt is the same thing for anybody even if he is not used to calculating in pounds, Btu, etc.

"Kilowatts or megawatts"—Would you express the surface of the U.S.A. in square inches or the price of a Cadillac in cents?

"Nuclear power plant" would be best. "Atomic" has a smell of bombastic advertisement and "fission power plant" will be outmoded when we have learned to tame for peacework nuclear reactions not based on fission (H-bomb).

10 kwhr as billing unit—No opinion as my company has very few customers where such a modification would be justified.

Robert G. Barteau

Compania General De Electricidad Industrial
Santiago, Chile

Reading in Multiples of Ten Kwhr Works

To the Editor:

In a recent issue of Electrical World a suggestion was made in one of your editorials that electric meters be read and customers billed in multiples of 10 kwhr.

We adopted the proctice of reading in multiples of ten, with the approval of our state commissions early in 1954. Readings are recorded to show the last multiple of ten kwhr that the indicators have recorded. The right hand dial is disregarded entirely and recorded as zero regardless of the actual reading. Under this plan we read the figure that the hand on the second dial (ten hand) has passed until the hand touches the next higher figure, then use that figure as the reading. In our opinion there is less chance of error under our plan than under the plan of reading to the nearest digit. The practice is applied to final readings as well as to regular scheduled readings.

To date we have not experienced one single complaint from the practice. With the increase in customer usage of electricity resulting from residential space heating and air conditioning with bimonthly readings, we were confronted with the use of a number of five-digit readings. We feel that reading in multiples of ten has solved our problem for some time to come. We strongly recommend the adoption of the plan to other utilities experiencing the same problem.

R. G. Schneider
Assistant Treasurer

Virginia Electric & Power Co
Richmond 9, Virginia

Let's Call Our Appliances 'Electric'

To the Editor:

This is written with the sole intent of producing thought. I would like to bring out into the open what seems to me quite an oversight but obviously doesn't bother anyone else.

I think we're letting ELECTRIC being taken for granted instead of exploiting this name we've given for the movement of free electrons along a conductor. Utilities produce electricity, and many manufacturers make appliances that are electric; yet in 80% of all ads you would never find it out. In the same breath I defy you to locate just one ad in a popular home magazine featuring a gas appliance without that little three-letter word. Furthermore it will appear larger than the ad's smallest print or else in bold type. You can't even go by the electric manufacturer's name anymore. The largest 'Electric Co' in the world also makes gas and oil appliances.

The gross injustice being done against this word ELECTRIC must be stopped. The following items are practically never called electric in their advertising: refrigerator, TV set, water pump, washer, radio, thermostat, air conditioner, timers, freezer, sweeper, mixer, iron, toaster, welder, sewing machine, etc. It seems to me that if all electric goods, whether they have a gas counterpart or not, were labelled "electric" in their ads, we would begin a beautiful blitz on the word "gas." Electrical goods must outnumber gas and oil by at least 20 to 1. Yet in the current issue of The American Home (serving over three million homemakers) the word gas appears 28 times while some form of electric can be found only 13 times. That nasty little word could have appeared in ten separate ads. "Electric" could have been displayed in 23 ads.

The next time a consumer goes into a store for a new appliance and the clerk asks, "Electric or gas?" let's see if we can have the customer reply, "Electric, of course! I didn't know there was any other kind."

Ed Henderson
Sr WO Closing Clerk

Indiana & Michigan Electric Co.
Fort Wayne, Ind.

• Perhaps the electrical industry is making a mistake in not using ELECTRIC more.

ABC...and the Reader

BACK IN 1914—forty-one years ago—a group of advertisers, advertising agencies and publishers joined in a project that has come to mean a great deal to the millions who, like you, read business magazines. The project, initiated at a time when circulation claims were rarely verified, was intended to achieve and maintain higher standards of integrity in publishing and advertising practice by providing means to audit paid circulation. Out of that effort came an organization known as the Audit Bureau of Circulations, a voluntary, non-profit, cooperative association, known for short as ABC. Its symbol appears at the head of this page.

We are proud that McGraw-Hill publications were among the founders and charter members of the Audit Bureau of Circulations.

Today the Bureau numbers 3,670 members. These include advertisers, agencies, and publishers of newspapers, farm papers, general magazines and business journals such as this one. These publisher members hold their memberships and their right to display the ABC symbol in their publications only so long as they live up to the circulation standards that are established through the Bureau.

It is one thing to set up high standards; it is another to see that those standards are maintained. This latter and all-important function is performed by a staff of auditors maintained by ABC to check periodically on the circulation practices of the publisher members. When a business magazine, such as this one, joins the Bureau it agrees that the ABC auditors shall have "the right of access to all books and records." Their inspection may dig into the files of original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, editorial expenses and many other significant items. Sometimes the auditors go behind the records and seek verification of purchase and payment from subscribers themselves.

The information thus obtained and certified by the Bureau then becomes available to the public and constitutes an authoritative report on the publication's circulation practices.

The advertisers and agencies benefit directly from the ABC because it provides a generally recognized factual yardstick by which the circulations of member publications can be measured and appraised. Every paragraph in an ABC report on a business publication gives the advertisers data that help them make intelligent use of the publication as an advertising medium.

But the ABC renders a service of vital concern to the *reader* as well. The Bureau audits paid circulation only, and it is through this payment, whether by subscription or newsstand purchase, that the reader keeps the editorial policy of a publication responsive to his needs. His decision to buy or not to buy records his judgment on each publication, and the ABC-audited and certified circulation reports make the sum of these judgments known to all concerned.

So the editors of ABC publications must constantly keep their editorial services up to the mark if they are to survive a competition in which the reader's right to buy or not to buy is paramount. Each paid magazine or newspaper will prosper or fail as it wins or loses the voluntary patronage of thousands or millions of readers. And—the ABC is scorekeeper in this vital contest.

Thus the publisher who submits his publication to the supervision and discipline of ABC affirms in the strongest possible manner his recognition that his primary obligation is to his readers and that he owes the standing of his publication to a voluntary demand by those readers.

All this is what makes the ABC brand on a publication so important to its readers. That respected symbol, testifying to the advertising value of the publication, serves also as a constant reminder to all concerned that the reader's willingness to pay for an ABC publication is the basic reason why it stays in business.

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WASHINGTON COMMENT

AEC Argues for Secrecy on H-Process

Question is whether research on fusion process for peacetime uses should be classified as a national security matter or released to public

A legal battle over Atomic Energy Commission control of information has developed which may have repercussions throughout the entire government security program.

Some of the nation's top legal minds are engaging in vigorous debate as to whether AEC may be violating provisions of the 1954 Atomic Energy Act, or even the Constitution, in keeping its program of research on controlled fusion under wraps (see p 109). This program is aimed at turning the energy released during fusion of hydrogen nuclei into electricity and holds great promise for power-hungry areas of the world. It went forward on a modest scale under the tightest security orders until Indian Representative Bhabha disclosed to the international conference on atomic energy, in Geneva this August that several nations were working on the problem.

AEC began work on fusion three years ago, setting up a coordinated program of theoretical research involving reevaluation of old laws of physics, mathematics, and chemistry, and establishment of new ones. The plan makes use of the nation's foremost scientists in these fields, most of whom are based on college campuses.

U. S. Would Have Told

The very fact that we had such a program was left to Bhabha to reveal at Geneva. At a subsequent press conference in Washington, AEC Chairman Lewis L. Strauss blandly stated that the U. S. delegation had planned to announce its program during one of its press conferences at Geneva, but the fact remains that Bhabha disclosed it first. Furthermore, when questioned by reporters on the status of the U. S. program, Strauss and his aides added little or nothing to the Bhabha statement.

The fusion situation is not the first instance of AEC secrecy which has drawn fire from other quarters in Washington. But it is the most dramatic.

Here is a program not yet out of the theory stage. It involves little in the way of concrete facts, still less of experience data. But the AEC indicates its belief that provisions of the 1954 Atomic Act give it the power to bottle up all knowledge in this brand-new field under its responsibilities toward the national defense and security.

May Contribute to National Security

The agency's argument hinges on the fact that in fusing hydrogen atoms, neutrons are released. These can be used in weapons production. Therefore, the security connection.

Advocates of less secrecy on fusion point out that another provision of the same law directs AEC to declassify all data the release of which would not be inimicable to the national defense and security.

AEC's contention that release of neutrons through fusion justifies complete secrecy over the subject may stand the test of time. If it does, thermonuclear research will be in the same category as the nuclear fission program of ten years ago—under a complete government monopoly. This means industry will be kept out till later in the game.

TECHNICAL NOTES

Difference between adjacent frequencies at which a variable frequency signal generator produces voltage peaks across the terminal of a cable is a useful method for accurately locating cable faults or open circuits.

Kvar of shunt capacitors to correct low voltage and power factor caused by kvar load on a distribution feeder accents a problem in nomenclature. Why not simplify it by designating lagging-load kvar **kval** and capacitative kvar **kvac?**

Carrier circuit involving two parallel paths may incur attenuation by out-of-phase arrival of signal over the longer path. Worst conditions occur when difference in path length is ½ wave length.

Several hundred Btu gain in plant economy could contribute to annual production economy savings commensurate with a 30% cut in maintenance expenditures.

Automation is applied to build the automatic controls to automate other industries.

Direct-buried nonmetallic-sheath cable should be buried at least 18 in., and deeper if required, to stay below the frost line.

Railway electrification in Europe cuts annual operating costs 50%. Successful electrification of British railways, opine the British, might precipitate more electrification in Canada and the U. S.

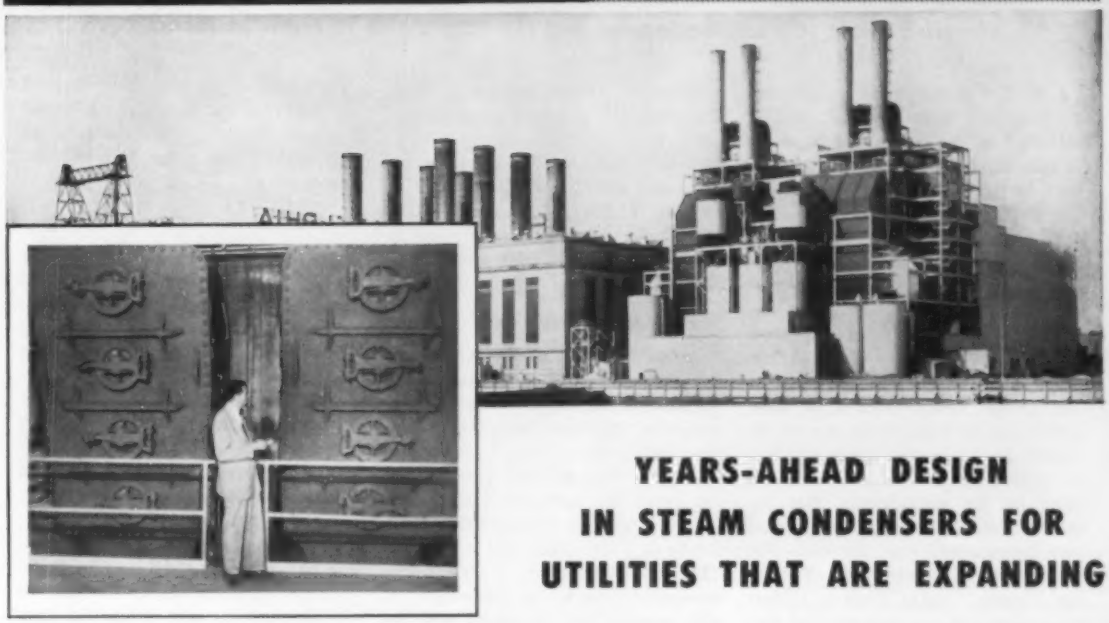
Discharging a high-voltage capacitor or a charged unfaulted phase of a cable intermittently through a gap to a faulted phase produces thumps at the fault which can usually be heard above ground and traced accurately to the point of fault.

Firefighting equipment, no matter how costly, is virtually useless at a station unless there is an adequate and trained crew to apply it to equipment in case of fire.

Aspen is hard to control by chemical sprays during its early years of growth because it spreads rapidly by root suckering.

IDEAS FOR ENGINEERS

FROM C.H. Wheeler OF PHILADELPHIA



YEARS-AHEAD DESIGN IN STEAM CONDENSERS FOR UTILITIES THAT ARE EXPANDING

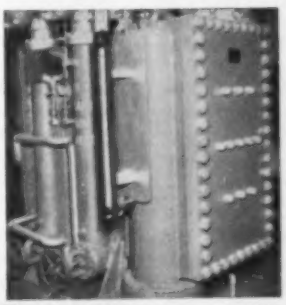
The Philadelphia Electric Company, for example, is one of the fastest growing utilities in the U. S. Here, men are thinking and working years ahead to take care of the "exploding" growth of the industrial Delaware Valley, and the ever-increasing population of Philadelphia, the "City of Homes". Nothing short of the most advanced design and efficiency of new equipment can be considered by the Philadelphia Electric Company to keep its generating capacity safely ahead of loading.

As part of their expansion program, two C. H. Wheeler 60,000 sq. ft. steam condensers are installed at the new Delaware Station. These are surface condensers of modern design; dual bank, single pass, divided water box type. Each unit condenses steam for a 125,000-kilowatt turbo-generator. Photo shows close-up of water box and manhole detail.

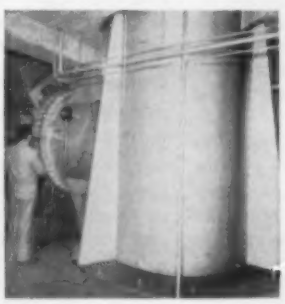
MAIN AIR EJECTORS ..by C. H. WHEELER

An important factor in the performance of the C. H. Wheeler Steam Condensers is the efficiency of the main air ejectors. C. H. Wheeler has always been the source for the latest developments in steam jet air ejectors.

The streamlined, steel-shell Tubejet Ejectors installed at the Delaware Station are effecting considerable savings in space and providing dependable removal of air.



HUGE C. H. WHEELER PUMPS DELIVER 86,500 GPM RIVER WATER



Other modern C. H. Wheeler installations at the new Delaware Station are the circulator pumps. C. H. Wheeler has closely integrated circulator pump design with modern steam generating demands. Pictured here is one of two vertical mixed flow circulating water pumps feeding Delaware River water to the new C. H. Wheeler Steam Condenser. Capacity of each pump is 86,500 GPM.

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FINANCE AND REGULATION

Fair Value Favored by Iowa Court

Iowa District Court rules in Iowa-Illinois Gas & Electric case that fair value doctrine tends to keep the income and the rate stable in terms of realities

A decision of the utmost importance to all utilities, both gas and electric, interested in the fair value doctrine for rate making purposes was handed down by the District Court in and for Webster County, Iowa, on Aug. 20, 1955.

The case was that of the Iowa-Illinois Gas & Electric Co, plaintiff, versus the City of Fort Dodge in the matter of setting a rate of return on the rate base used in the distribution of natural gas to the municipality of Fort Dodge. Since there is no state commission in Iowa, rates are set by "Home Rule." In this instance it was an appeal by the company from a claim by the municipality that the rate base should be based on "original cost depreciated" that the case was taken to the District Court of Webster County. Judge Harvey Uhlenhopp wrote this important and far-reaching decision.

Court Stresses Inflation

The court in its findings laid heavy stress on inflation which had taken place since 1939 and as to the equity of apportioning this burden between customers and stockholders.

Noting that prices have increased 89.5% for consumer prices, 108.8% for wholesale prices and that gas plant construction costs increased 136.7%, the opinion stated: "It is as though we are using a different currence than in the former days. Practically all segments of the economy are using a reduced unit of exchange.

"Should the utilities be required to put up their property in terms of the high old unit while receiving the cheap new unit at the counter? Must this utility value its 1882 mains, still in service, in 1882 dollars? Such a result practically gives the consumer the benefit of ownership.

"If the consumers wish to own the property they should buy it outright. Then the ostensible gains and losses resulting from price fluctuations will be theirs. But adherence to original cost when the property is in fact privately owned neither gives the stockholder a real income in high times nor the ratepayer a real rate in low.

"Fair value tends to keep the income and the rate stable in terms of realities. Utility returns and the cost of utility service remain more constant in terms of hours of labor and bushels of corn."

Stockholder Is Risk Taker

Answering the all too frequently held contention of some regulatory bodies that the utility stockholder is somehow different from his industrial counterpart, Judge Uhlenhopp noted that "It is no answer to say that the owner has such a sure thing that his stock is really a bond. The stockholder is a risk-taker, not a creditor. The capital structure of the utility enterprise includes a proportion of risk capital, and risktakers will demand to go forward with the economy.

"To think that the stockholder takes no risk because the utility has a captive market is to forget numerous companies which failed in the not distant past with stockholders wiped out and bondholders partly unpaid—hard times, decadent communities and industries, or changes in the art. What happened to the street railway and manufactured gas? Who knows how long natural gas will be used or available, or whether Fort Dodge will continue a profitable market?"

Owners Face Many Risks

"If things go bad and the utility fails, there will be no ratepayer's hand to make sure it gets back its original cost. The regulatory lag, the danger of premature obsolescence, the differences in methods of regulatory bodies (of which indeed the utility complains here) are other risks the owners face. It is true the utilities have the privilege of franchise. Their rate of return is correspondingly low. But the franchise does not guarantee success—only a fair race."

Noting that adherence to original cost tends to make utility managements less enterprising, the opinion said: "The other objection is that original cost takes the viable quality out of this business. It is to the interest of all that utilities like other industries be enterprising."

Original Cost: Mechanical Thing

"Original cost makes regulation easy, but it gives away something more valuable. Tying the utility to original cost prevents it from going forward with other industry: it is in a regulatory straight-jacket. It becomes a dull, mechanical thing. Why advance and take chances? Will not more enterprise be shown if more risks are placed on the industry and it is allowed to go upward or downward with the country?

"Industrial measuring and regulating equipment has doubled in price. Will management be encouraged to pay the present high prices for such equipment when it sees today's return paid in terms of yesterday's dollars? Would not the industry be more alive if the risks were on the investors and they were rewarded in terms of current values?"

Fair Value: A Judged Figure

"Let the stockholders stand the regulatory expense as an example—a risk which the owners should bear; let them stand the cost of equipment rendered suddenly obsolete. Yet mechanical application of original cost has required these and other expenses to be shouldered by consumers."

The contention of some proponents of original cost that even if it is unfair to a utility it has the seeming advantage of being easily administered is summarily dealt with by the court's opinion when it said: "The charge is true that fair value is not a single figure to which one is unerringly led by the application of a certain formula. It is a judged figure. This disturbs those whose desire for certainty requires everything to be settled mechanically.

"The result obtained by inspection of accounts for original cost is certain, but it may also be unfair or

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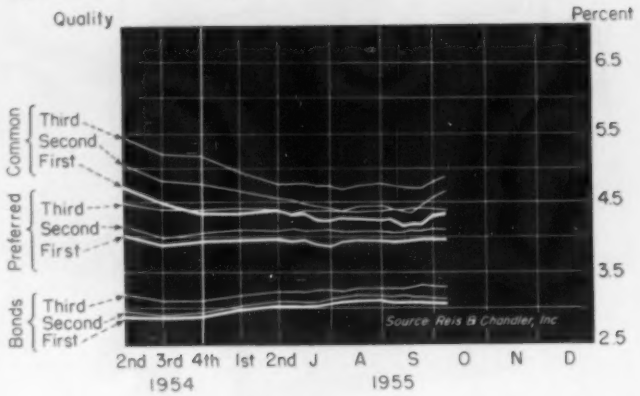
otherwise undesirable. Everyone likes certainty, but there are areas in the law where justice calls for judgment and opinion. It is not always possible merely to add up numbers. The best we can do in these instances is to admit only intelligent opinions and then select what appears the most reliable among them."

As to the rate of return, the court quoting the Bluefield Case parenthetically said: "The utility is entitled to expect a rate of return on its property comparable to what other industries are getting which are located in this part of the country and have similar risks."

As to the rate base, the court, after considering net original cost and reproduction cost new less depreciation, found the fair value rate base to be 37% in excess of net original cost, or at approximately midpoint between net original and reproduction cost new depreciated.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Oct. 6	3.09	3.13	3.31	3.98	4.09	4.38	4.34	4.63	4.86
Sept. 29	3.11	3.15	3.32	3.98	4.11	4.39	4.31	4.57	4.79

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Central Illinois Light	12	Aug.	$3,596,815	$3,503,260	$3.10(a)	$3.05(a)
Consumers Power	12	Aug.	27,917,132	26,062,293	3.27(a)	3.13(a)
Texas Electric Service	12	Aug.	10,590,614	9,925,185	....	....

Notes—(a) Based on average number of shares.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
OCTOBER 5-11			
PREFERRED STOCK			
Pacific Power & Light—30,000 sh 4.52% $100 par	$3,060	$102.00	4.43%
COMMON STOCK			
Central Maine—506,317 sh (being offered commonholders on 1-for-5 basis and to 6% preferred stockholders on sh-for-sh basis, record Sept. 30 to expire Oct. 19; unsubscribed stock up to 20,000 sh will be offered to employees on the basis of not less than five shs nor more than 50 shs to each employee.)	$12,341	$24.375	5.74%
SCHEDULE FOR OCTOBER			
BONDS			BID DATE
Worcester County Electric—1st mtg due 1985	$8,500	.....	Oct. 18
New York State Electric & Gas—1st mtg due 1985	15,000	.....	Oct. 19
Long Island Lighting—1st mtg due 1985	15,000	.....	Oct. 26
PREFERRED STOCK			
Pacific Gas & Electric—1,000,000 sh $25 par	.....	.....	Oct. 25(a)
COMMON STOCK			
Louisville Gas & Electric—160,000 sh (to be offered commonholders on 1-for-10 basis, record about Oct. 13 to expire Nov. 1)	$.....	.....	.....
New York State Electric & Gas—303,407 sh (to be offered commonholders on 1-for-10 basis, record Oct. 18)	.....	.....	.....
Indianapolis Power & Light—209,685 sh (to be offered commonholders on 1-for-15 basis, record Oct. 27	.....	.....	.....

Note—(a) Blyth & Co, underwriter.

FINANCIAL BRIEFS

Common Stock Dividend Increases— Western Light & Telephone Co will pay Nov. 1 a quarterly common stock dividend of 45¢ a share as compared with 40¢ in the previous quarter . . . Sierra Pacific Power Co will pay Nov. 1 a quarterly common stock dividend of 28¢ a share. Prior to the two-for-one stock split in September, the company was paying 50¢ a share a quarter.

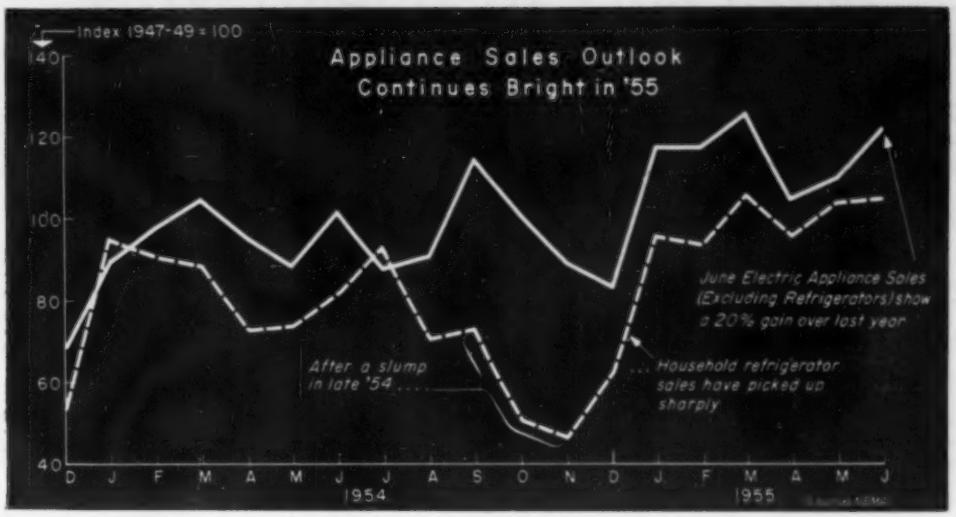
Central Electric & Gas Co is planning to sell $1,750,000 first mortgage bonds 3.875% due 1980 to the Equitable Life Assurance Society of the United States. Company is also planning to sell 15,000 shares of common stock and 35,000 shares of 4.75% cumulative preferred stock.

Pursuant to American Power & Light Co's dissolution plan, trustees are planning to make an interim distribution of $1.44 a share in partial liquidation on Oct. 31.

Shelter Island Light & Power Co has increased its authorized capital stock from $30,000 to $45,000.

Consolidated Edison Co of New York has arranged with 15 local commercial banks for a $100 million credit to run until Oct. 9, 1956.

STATISTICS


Index 1947-49 = 100
Appliance Sales Outlook Continues Bright in '55
140
120
100
80
60
40
After a slump in late '54 . . .
. . . Household refrigerator sales have picked up sharply
June Electric Appliance Sales (Excluding Refrigerators) show a 20% gain over last year
D J F M A M J J A S O N D J F M A M J
1954
1955

Power Statistics . . .

			Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	million kw	July	108.79	107.62	96.98	12.2
Peak—Class I Systems	million kw	July	89.3	86.6	78.2	14.2
Estimated Dec. '55 Peak	million kw	July	96.3	96.6	96.1	0.2
Production—billion kwhr		July	46.63	44.23	40.12	16.2
Hydro			9.35	9.71	8.75	6.8
Fuel			37.28	34.53	31.38	18.8
Sales—billion kwhr		July	40.89	40.17	35.01	16.8
Residential			9.89	9.57	9.11	8.5
Commercial			6.92	6.48	6.40	8.0
Industrial			21.50	21.75	16.97	26.7
Other			2.59	2.38	2.51	2.9
Fuel Consumption		July				
Coal—million tons			11.72	11.07	9.41	24.5
Oil—million barrels			4.62	4.69	4.44	3.9
Gas—billion cu ft			126.25	107.42	128.36	−1.6
Net Income Class A & B Co's—$ million		July	89.87	96.75	83.84	7.2
Residential Customers—millions		12 mos.	43.83	43.74	42.57	3.0
Revenue per kwhr		ended	2.66¢	2.67¢	2.71¢	−1.9
Avg kwhr per customer		July	2,662	2,649	2,459	8.3
Avg annual bill			$70.81	$70.73	$66.64	6.3

Business Statistics . . .

Indexes: 1947-49 = 100					
FRB Industrial Production	Aug.	140	131	123	13.8
ENR Construction Cost	Sept.	141.0	141.0	134.3	5.0
BLS Cost-of-living	Aug.	114.5	114.7	115.0	−0.4
NEMA Sales	June				
Insulation materials		158	154	124	27.4
Electric appliances		122	110	102	19.6
Household refrigerators		105	104	82	28.0
Wholesale prices	Aug.				
Motors and generators		121.5	121.5	123.1	−1.3
Transformers and regulators		127.3	127.3	128.1	−0.6
Switchgear and fuses		139.2	135.5	135.1	3.0
GNP—annual rate—$ billion	2nd Qtr.	$385.0	$375.3	$357.6	7.1

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The year's biggest truck news is right here on this page!

New INTERNATIONALS!

All-Truck Built to save you the BIG money!

It's here! A great new line of light, medium and heavy-duty INTERNATIONALS from 4,200 to 33,000 lbs. GVW. They're *all truck*, with no passenger car components asked to do a truck job . . . with more features than ever for BIG money savings, in operating and maintenance costs.

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They have smart, functional styling for easy, economical maintenance, even on the roughest truck jobs. They have driver-saving cabs that let drivers work longer without fatigue. First chance you get, see these good-looking, easy-working, BIG money-saving INTERNATIONAL Trucks.

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INTERNATIONAL® TRUCKS

Motor Trucks • Crawler Tractors • Industrial Power
McCormick® Farm Equipment and Farmall® Tractors

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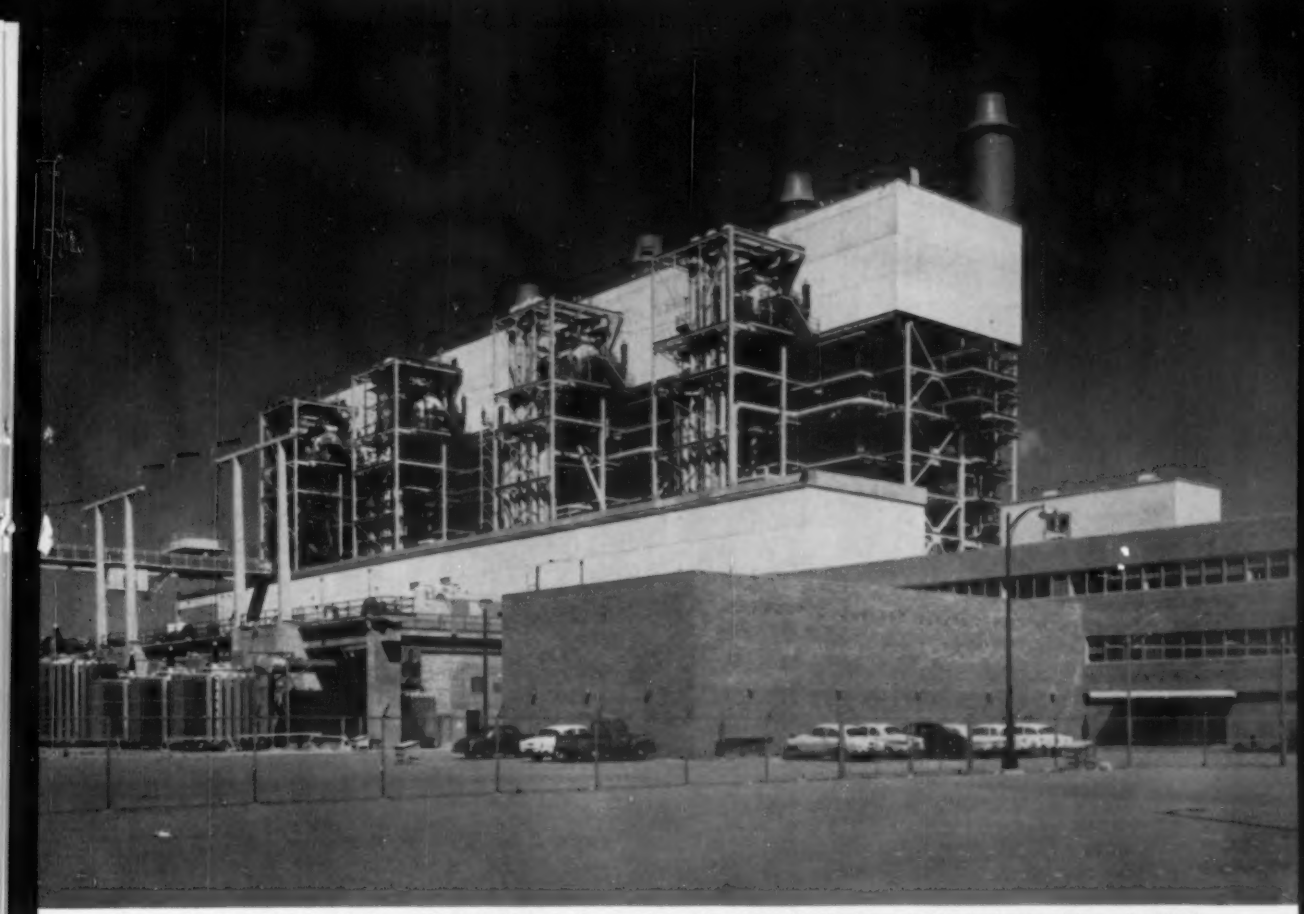

Ultra-modern plant! The Pacific Gas and Electric Company has recently put into operation the steam electric plant pictured here—the West's largest! Closed-circuit television and other advanced features have been incorporated into this mammoth Pittsburg, Calif., power plant.

For positive operation of switchgear . . .

the West's largest steam plant uses Exide-Manchex Batteries!

Exide-Manchex batteries with time-proven performance, control the switchgear equipment in the largest steam electric plant ever built west of the Mississippi. Whenever Exides are used positive switchgear performance helps to assure service continuity.

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State of charge easily determined by simple hydrometer reading

No electrolyte change during entire life of battery

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Large capacity in small space

Exceptionally long life . . . low cost for owning and operating

These are the performance and operating features of the Exide-Manchex battery which make it your best power buy—AT ANY PRICE.

Get more details! Bulletin 210 has complete data on Exides used for switchgear control, emergency light and power. Write for your copy today—no obligation. Contact your nearby Exide branch office for complete battery engineering service.

Exide-Manchex Batteries, like those relied upon at the new Pittsburg, Calif., plant of the Pacific Gas and Electric Company, are also used by electric utilities all over the country. Exide-Manchex batteries are your best switchgear power buy—AT ANY PRICE!

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Save Money on Load Checks

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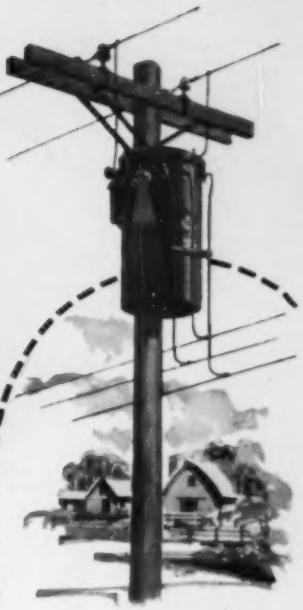

"the click does the trick"

Let Low-cost *Thermalite* Indicators Single Out Overloaded Transformers . . . Eliminate Waste of Time and Money Checking Every Unit

YOUR SERVICEMEN CAN SEE from the cab of a truck whether a transformer needs a load check when it is equipped with a *Thermalite* overload indicator. You get continuous, automatic indication of which units need attention without time-consuming load surveys.

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Low-cost *Thermalite* indicators on your transformers let you utilize the inherent overload capability of the distribution transformers on your system. Get them on Allis-Chalmers transformers 100 kva and smaller, 15 kv and below. Write or call your nearby A-C office, or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for more information.

Heart of the *Thermalite* indicator is this snap-acting disc that "clicks" at a predetermined temperature to actuate the signal lamp. Its reliability has been thoroughly proved in millions of applications where thermostatic control is vital — on aircraft, on automotive equipment, and for heating and refrigerating applications.

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